PRESTON

GM SERIES

A/D

A/D CONVERSION SYSTEMS

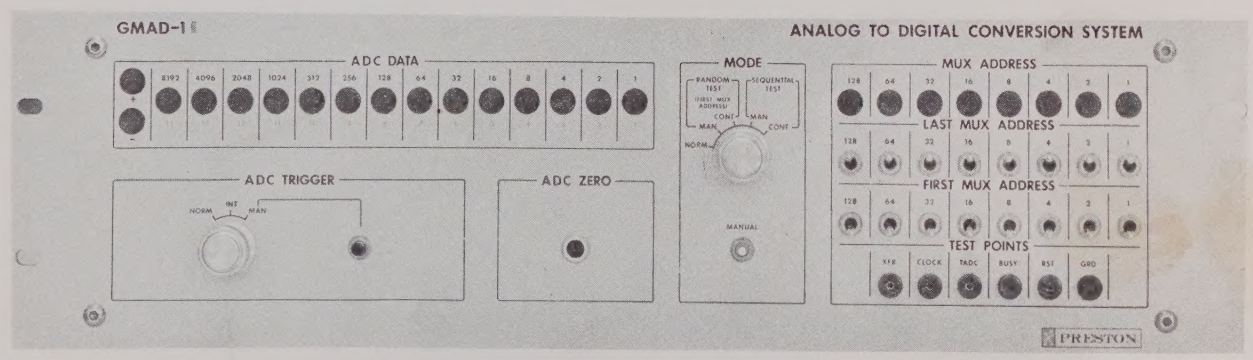
RETURN TO
TEST EQUIPMENT
FILE

RETURN TO
TEST EQUIPMENT
FILE

GM SERIES

ANALOG-TO-DIGITAL CONVERSION

SYSTEMS



RETURN TO
TEST EQUIPMENT
FILE

Sample & Hold Card GMAD 3 ??
Cust Service.
Check Curves.

PRESTON
SCIENTIFIC INCORPORATED
805 East Cerritos Ave., Anaheim, Calif. 92805
Tel. (714) 776-6400

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_11256

TABLE OF CONTENTS

BASIC OPERATING INSTRUCTIONS	SECTION 1
BASIC THEORY	SECTION 2
GENERAL CALIBRATION	SECTION 3
STANDARD SPECIFICATIONS	SECTION 4
DRAWINGS	SECTION 5
TEST REPORT	SECTION 6
TROUBLESHOOTING	SECTION 7
APPENDIX	

GMAD-3 CONNECTOR LIST Back of Book.

SECTION 1

SECTION 1

BASIC OPERATING INSTRUCTIONS

1.1 INITIAL PROCEDURES

The GM Analog-to-Digital Conversion System card modules are designed to be mounted into a standard 19-inch RETMA Relay Rack. To prevent damage to the front panel, nylon filler washers should be placed under the rack mounting screws. For correct weight distribution, drawer slides must be used for support. The unit has an integral fan; ambient air should be less than 50°C.

The power connector location is indicated on the top assembly drawing. The standard power connector is a twist-lock, male connector recessed into the rear panel of the unit. A matching connector with cord isnormally supplied with the unit. A fuse and power switch are also located at the rear of the instrument. Individual input, output, and control line connectors are designed per the customer's specification, and it will be necessary to refer to the top assembly drawing for their location.

1.2 MULTIPLEXER FRONT PANEL CONTROLS (Refer to Figure 1.1)

1.2.1 First Channel Address: Selection of single channel address when MODE Switch is in RANDOM TEST, MAN or CONT; selection of first channel in a series when MODE Switch is in SEQUENTIAL TEST, MAN or CONT.

1.2.2 Last Channel Address: Selection of last channel when MODE Switch is in SEQUENTIAL TEST, MAN or CONT.

1.2.3 MODE Switch

(a) NORMAL . . . In this position, the control of the multiplexer is at the customer's command via the rear connectors. See Section 1.4 for the standard input and output control lines.

(b) RANDOM TEST . . . Relates to the FIRST MUX ADDRESS only. When the MODE Switch is in the RANDOM TEST MAN position, depressing the manual button will repeatedly select the channel indicated by the FIRST MUX ADDRESS.

(c) SEQUENTIAL TEST . . . This position incorporates both FIRST MUX ADDRESS and LAST MUX ADDRESS. When the MODE Switch is in the SEQUENTIAL TEST MAN position, depressing the manual button will select, in order, the channels between and including the FIRST and LAST MUX ADDRESS. Turning the MODE Switch to the SEQUENTIAL TEST CONT position will allow an internal clock to sequence through the channels between and including the FIRST and LAST MUX ADDRESS.

(d) TEST POINTS . . . Monitoring points only for specified signals of interest (may vary with customer's specification).

1.3 ADC FRONT PANEL CONTROLS (Refer to Figure 1.1)

1.3.1 ADC Trigger

(a) NORMAL . . . Customer-controlled by signals at rear connector (TADC) when unit is purchased without a multiplexer. When there is a multiplexer with the GMC Logic Control Package in combination with the ADC, the

1.3.1 (a) (continued)

multiplexer will trigger the ADC when the ADC TRIGGER Switch is in the NORMAL position.

(b) INT . . . An internal clocked rate of 10 conversions per second, independent of multiplexer or ex ternal command; an asynchronous condition, external and MUX generated TADC disconnected.

(c) MAN . . . Digitizing command by front panel pushbutton command only, independent of external or multiplexer commands.

1.4 STANDARD INPUT AND OUTPUT CONTROL LINES

The control lines described in the following paragraphs are located at the rear connector. These lines are,for the most part, standard and most of the conceivable exceptions will be noted and explained where applicable. For the exact external rear connector for your instrument, please refer to the customer connection drawing located in Section 5.

1.4.1 Input Control Lines

(a) TADC . . . The TRIGGER ADC (TADC) pulse, also known as START CONVERT, is available at the rear panel when the ADC is purchased without a multiplexer. The TADC pulse is externally applied in this configuration and is a TTL compatible pulse, 50 nanoseconds minimum in width. This pulse will only start the conversion when the front panel MODE Switch is in the NORMAL position. When the front panel MODE Switch is in either INT (internal) or MAN (manual), the rear panel TADC

1.4.1 (a) (continued)

will not start the conversion process. When the TADC function is not being used, it should be tied to digital ground.

(b) ADDRESS . . . This is a multiplexer channel address externally furnished to randomly select a particular multiplexer channel. A TTL compatible binary word of four or more bits in length is required. This address is only effective when the front panel GMC Control Package MODE Switch is in the NORMAL position.

(c) TRANSFER . . . The TRANSFER function is an externally furnished TTL pulse of 50 nanoseconds minimum in width. When the TRANSFER function is TRUE, the channel selected by the ADDRESS (rear panel) is gated into an internal register and sets up some internal timing to the multiplexer or MUX-ADC combination, to complete conversion of the selected channel. This function is only effective when the front panel GMC Control Package MODE Switch is in the NORMAL position. When the TRANSFER function is not being used, it should be tied to digital ground.

(d) ADVANCE . . . The ADVANCE function is an externally furnished TTL pulse, 50 nanoseconds minimum in width, used for sequential advancement of the multiplexer channels. When the ADVANCE is TRUE, the internal channel sequencing register will advance one count and set up the internal timing to the multiplexer or the MUX-ADC combination to complete conversion

1.4.1 (d) (continued)

The ADVANCE function is only effective when the front panel GMC Control Package MODE Switch is in the NORMAL position. However, selection of the channels to be sequenced are still controlled by the front panel FIRST MUX ADDRESS and LAST MUX ADDRESS.

An exception to the above statement is observed when a channel has been previously selected by the TRANSFER function (random access channel ADDRESS). In this case, initiating an ADVANCE pulse will step the multiplexer to the next higher numbered channel.

When the channel selected by the LAST MUX ADDRESS is reached, an internal RESET pulse will be generated and the channel indicated by the FIRST MUX ADDRESS will be selected. When the ADVANCE function is not being used, it should be tied to digital ground.

(e) RESET . . . The RESET function is an externally furnished TTL pulse, 50 nanoseconds minimum in width, used to reset the internal register to the channel selected by the front panel FIRST MUX ADDRESS. Application of the RESET function will initiate a conversion upon return to the channel selected by the FIRST MUX ADDRESS. When the RESET function is not being used, it should be tied to the digital ground.

RETURN TO
TEST EQUIPMENT
FILE

1.4.2 Output Control Lines

(a) BUSY . . . The BUSY function is provided at the rear panel. This function is a TTL level and remains true while the ADC is in the conversion process. This signal goes false when conversion is complete. Please refer to the timing diagram in Section 6 for the particular timing sequence describing this unit.

(b) EOC . . . The EOC function is an internal signal used to reset the sample-and-hold amplifier into the sample state in preparation for the next channel of the multiplexer. The EOC function is available at the rear panel as a TTL pulse of 100 nanoseconds in width, for use as an "end-of-conversion" indication. Please refer to the timing diagram in Section 6 for the particular timing sequence describing this unit.

(c) NORMAL MODE . . . The NORMAL MODE function relates to the position of the front panel MODE Switches for either or both the ADC and the multiplexer. When these front panel switches are placed in the NORM position, the signal on the designated pin of the rear connector (see customer connection drawing in Section 6) will appear open (no connection). If either switch is changed to another position, the signal at the rear connector will appear as a ground.

1.5 SAMPLE-AND-HOLD CONTROL LOGIC

Each one of the sample-and-hold boards has its own control logic. The logic diagram is pictured in Figure 1.2. Refer to the chart in Figure 1.3 for the different ways to control the sample-and-hold modes and their subsequent logic connections.

Common types of control are:

(a) A pulse on the sample line to obtain the sample mode, and a pulse on the hold line to obtain the hold mode

(b) Single line drive sample logic line; true for sample, false for hold

(c) Single line drive, hold logic line; true for hold, false for sample

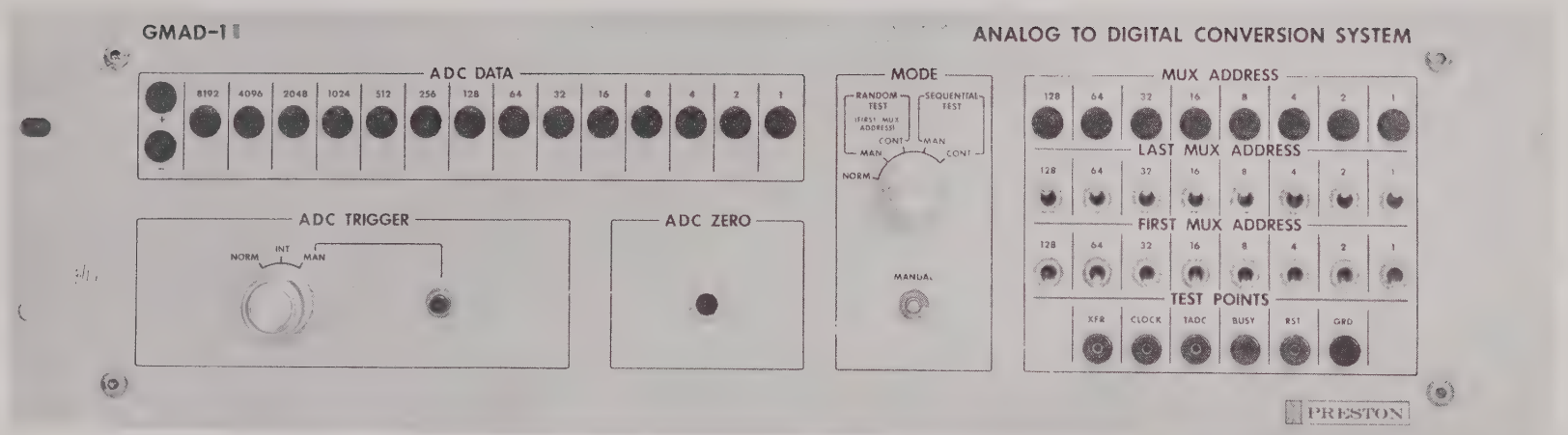

GMAD-11
ANALOG TO DIGITAL CONVERSION SYSTEM
ADC DATA
+
-
8192
4096
2048
1024
512
256
128
64
32
16
8
4
2
1
ADC TRIGGER
NORM
INT
MAN
ADC ZERO
MODE
RANDOM TEST
(FIRST MUX ADDRESS)
SEQUENTIAL TEST
CONT
MAN
MAN
CONT
NORM
MANUAL
MUX ADDRESS
LAST MUX ADDRESS
FIRST MUX ADDRESS
TEST POINTS
XFR
CLOCK
TADC
BUSY
RST
GRD
PRESTON

FIGURE 1.1

RETURN TO
TEST EQUIPMENT
FILE

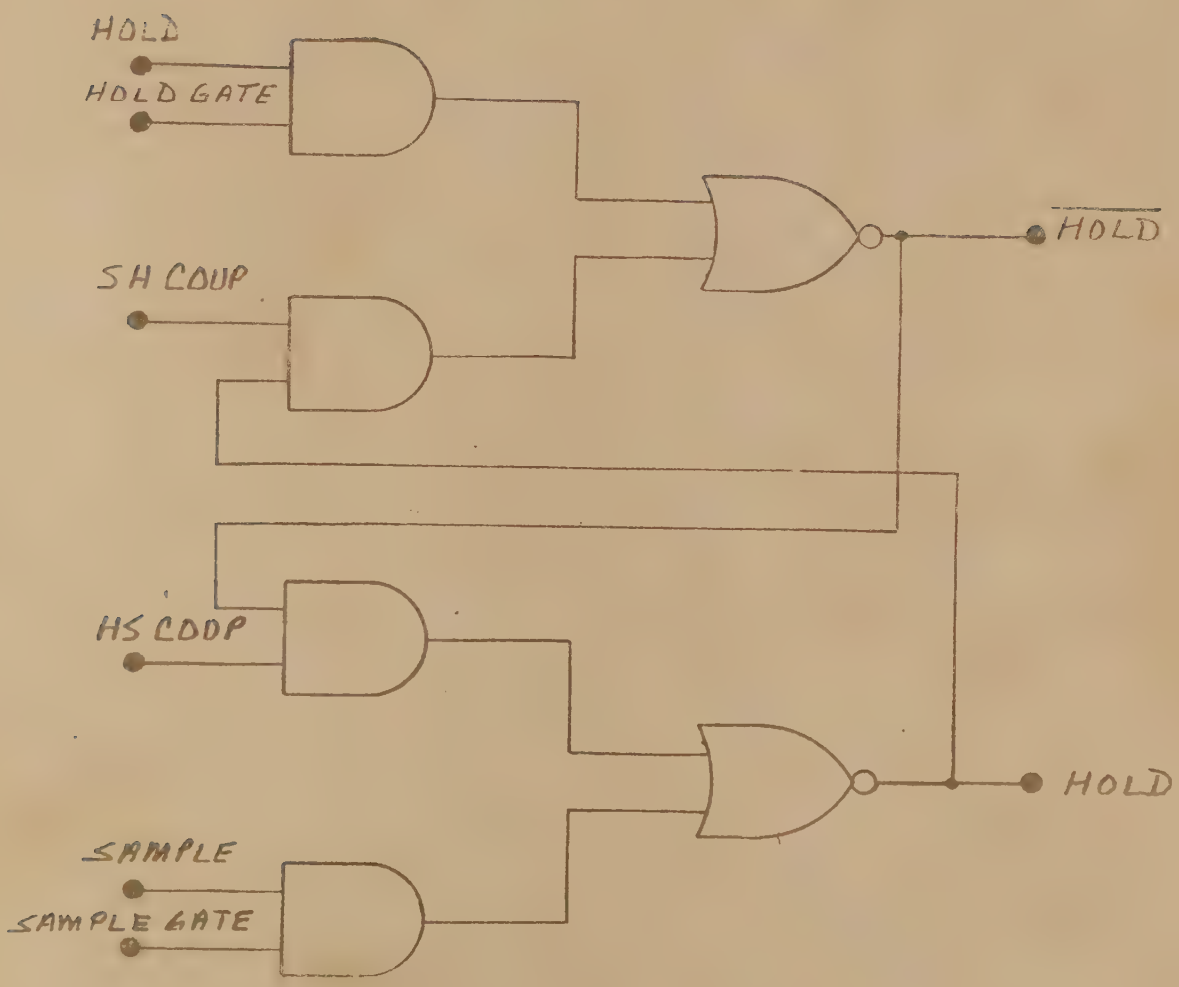


Figure 1.2

	HOLD	HOLD GATE	SH COUP	SAMPLE	SAMPLE GATE	HS COUP
PULSE TO SAMPLE	D	T	T	D	T	T
PULSE TO HOLD	T	D		T	D	
DRIVE TRUE FOR SAMPLE	X	0	T	D	T	F
	0	X		T	D	
DRIVE TRUE FOR HOLD	D	T	F	X	0	T
	T	D		0	X	

X = UNUSED

0 = KEPT AT LOW LOGIC LEVEL

T = TRUE

F = FALSE

D = DRIVE

Figure 1.3

SECTION 2

SECTION 2

THEORY

2.1 THEORY OF OPERATION

The GM series Analog-to-Digital Converter consists of a series of identical units. Each unit consists of two basic elements. These elements are: (1) an analog converter for each individual bit and (2) a logic storage and decoding section for each individual bit (refer to Figure 2.1).

In the GM Analog-to-Digital Converter, several of the above described units are connected in series as indicated in Figure 2.1, and each amplifier receives, as its input, the output of the preceding amplifier.

Each individual analog converter bit is identical in operation. Schematically, the bit board (printed circuit) will change from the MSB to the LSB due to the increased resolution of each successive bit board.

Using the block diagram in Figure 2.1, note that each bit, including the sign, has its own analog converter and logic storage. The buffer is used to provide a high impedance to the source.

Each converter stage has the same transfer function as indicated in Figure 2.2. If the X axis is the input signal of each of the analog converters, then the Y axis is the resultant analog output of the converter; e.g., as the input varies from

minus 10 volts to plus 10 volts, the resultant output of the analog converter will vary from plus 10 volts to minus 10 volts and back to plus 10 volts.

The analog converter is designed to give a logic output as follows. For all positive inputs, the logic output will be a "1" and for all negative inputs, the logic output will be "0." Actually, both the logic described and its complement are available at each board and each is used depending upon the application, as will be seen in the following paragraphs.

Figure 2.3 shows the operation of a minus 10 volt to plus 10 volt signal and the subsequent outputs of each amplifier, along with the logic ("1" or "0"). In this particular example of the GM ADC, all bit logic outputs following the most significant bit have been inverted so that, for positive inputs, a logic "0" is realized and for negative inputs, a logic "1" is realized. In this manner, a Gray code logic may be obtained as a representative digital value of the input to the ADC.

The ADC operates in the Gray code rather than normal binary because it allows the progression of the code to advance only one bit at a time. To convert the Gray code into normal binary, the storage and decoding sections (see Figure 2.3) use the following process: Starting with the MSB, each time a bit is preceded by a logical "1," that bit is reversed ("0" to a "1" and vice-versa). See the binary and Gray codes in Figure 2.3 for an example.

The GM Analog-to-Digital Converter follows the input signal at all times. To receive a digital representation of the input at any time, all that is necessary is to gate all of the logic, storage and decoding sections simultaneously. The logic is then converted from a Gray code to binary and released to the output.

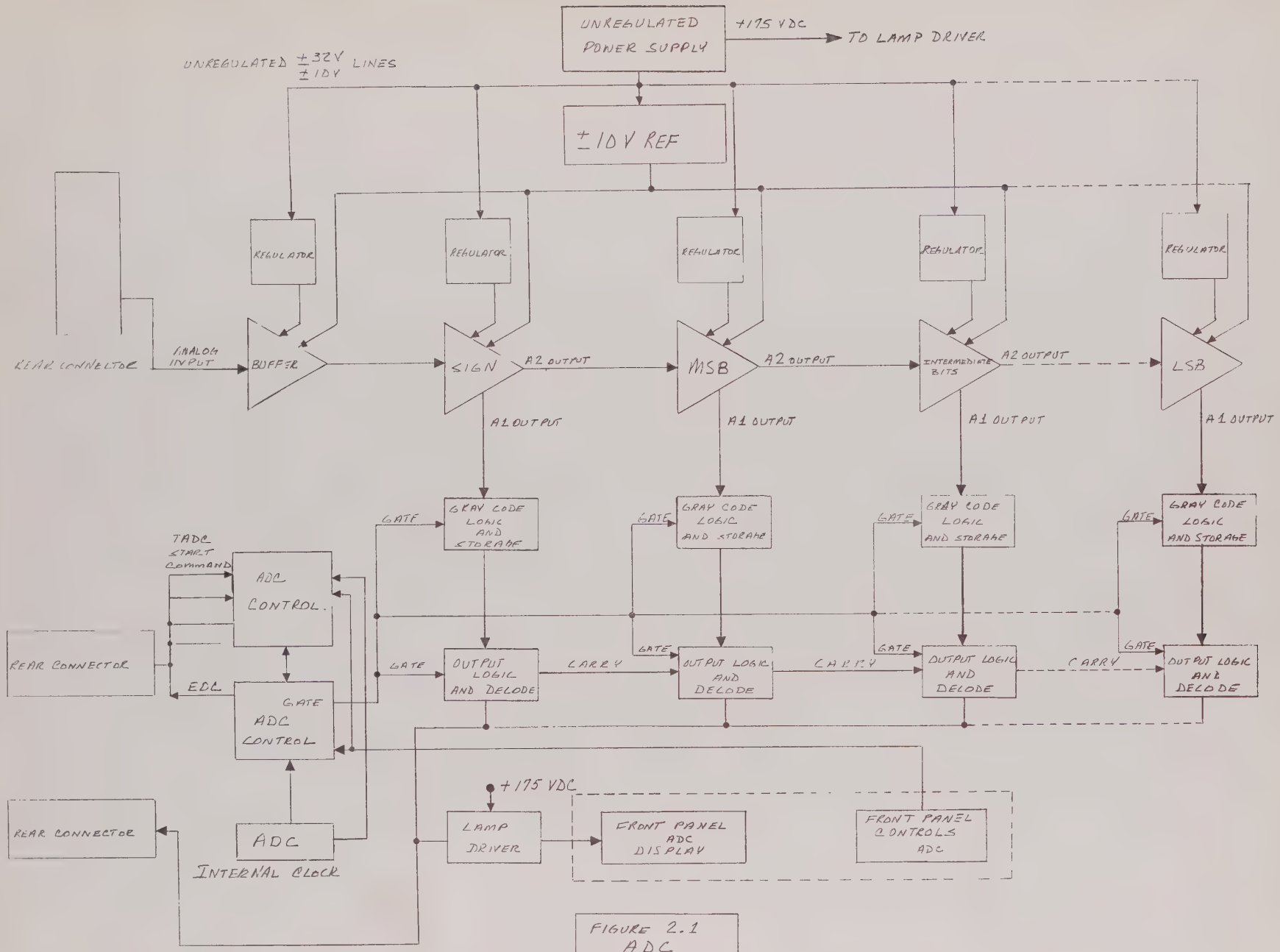


FIGURE 2.1
ADC
BLOCK DIAGRAM

GMAD - BUFFER

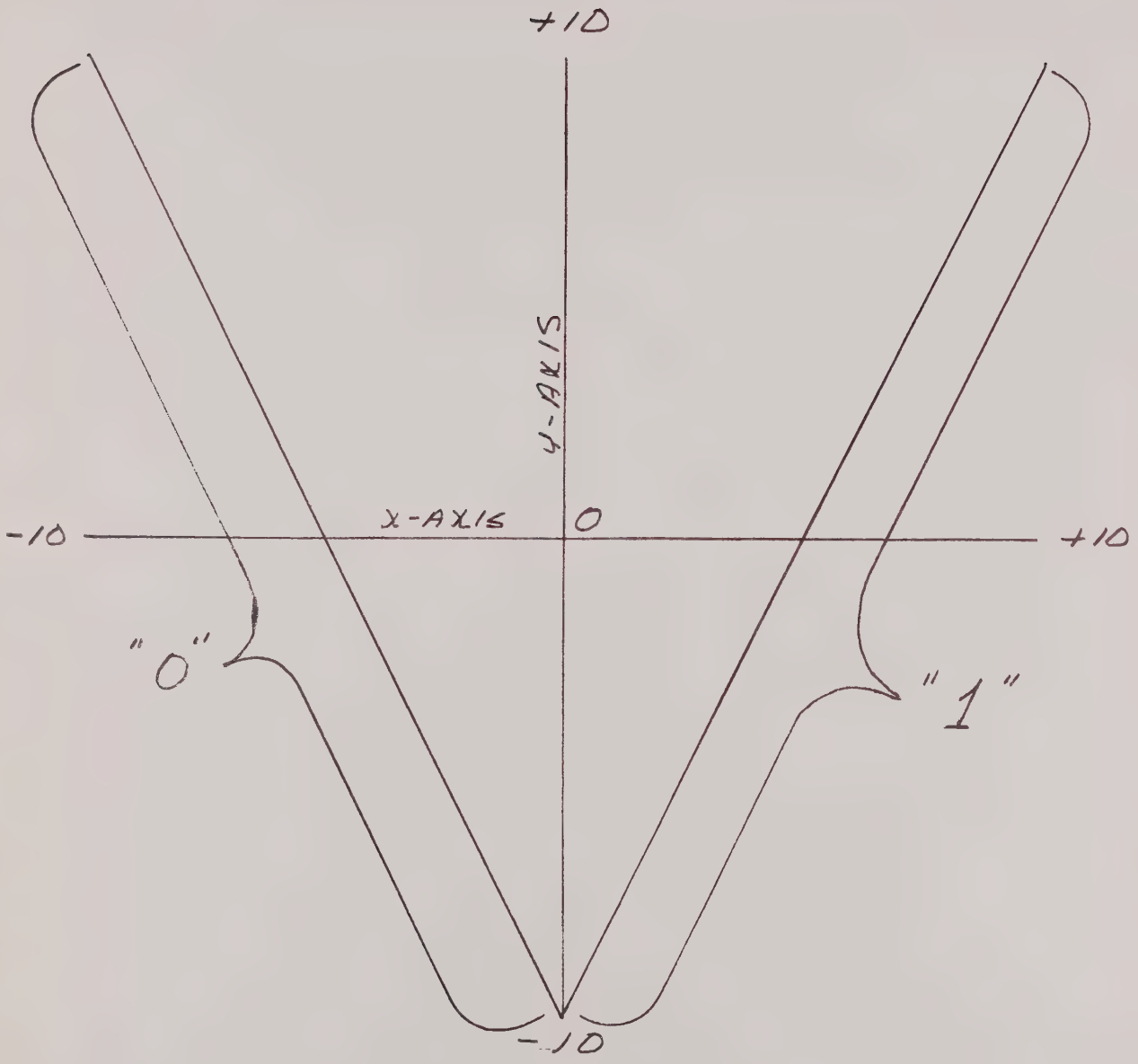


FIGURE 2.2

2.2 BIT BOARD

Figure 2.4 is a block diagram of a bit board. The diagram includes the input amplifier (A1), the output amplifier (A2), the zero crossing detectors, the logic storage and decode logic.

Amplifier A1 output is connected to the zero crossing detectors and, depending upon whether the input to the amplifier is negative or positive, sets the logic of IC A3. The logic of IC A3 is stored at IC A3 until the GATE pulse is received. When the GATE pulse is received (the GATE pulse is also named UPDATE ADC and may be observed at the control board on test point marked DELAY 2), the logic is transferred to the IC's A1 and A2. Through interconnection with the subsequent and preceding bit boards, the Gray code is converted into the correct binary output.

The output of Amplifier A2 is fed to the input of the next bit board and the above process is repeated.

In operation, when all of the bit board's logic is settled and stored, the GATE pulse is applied and the digital representation of the analog input appears at the output and is displayed on the front panel.

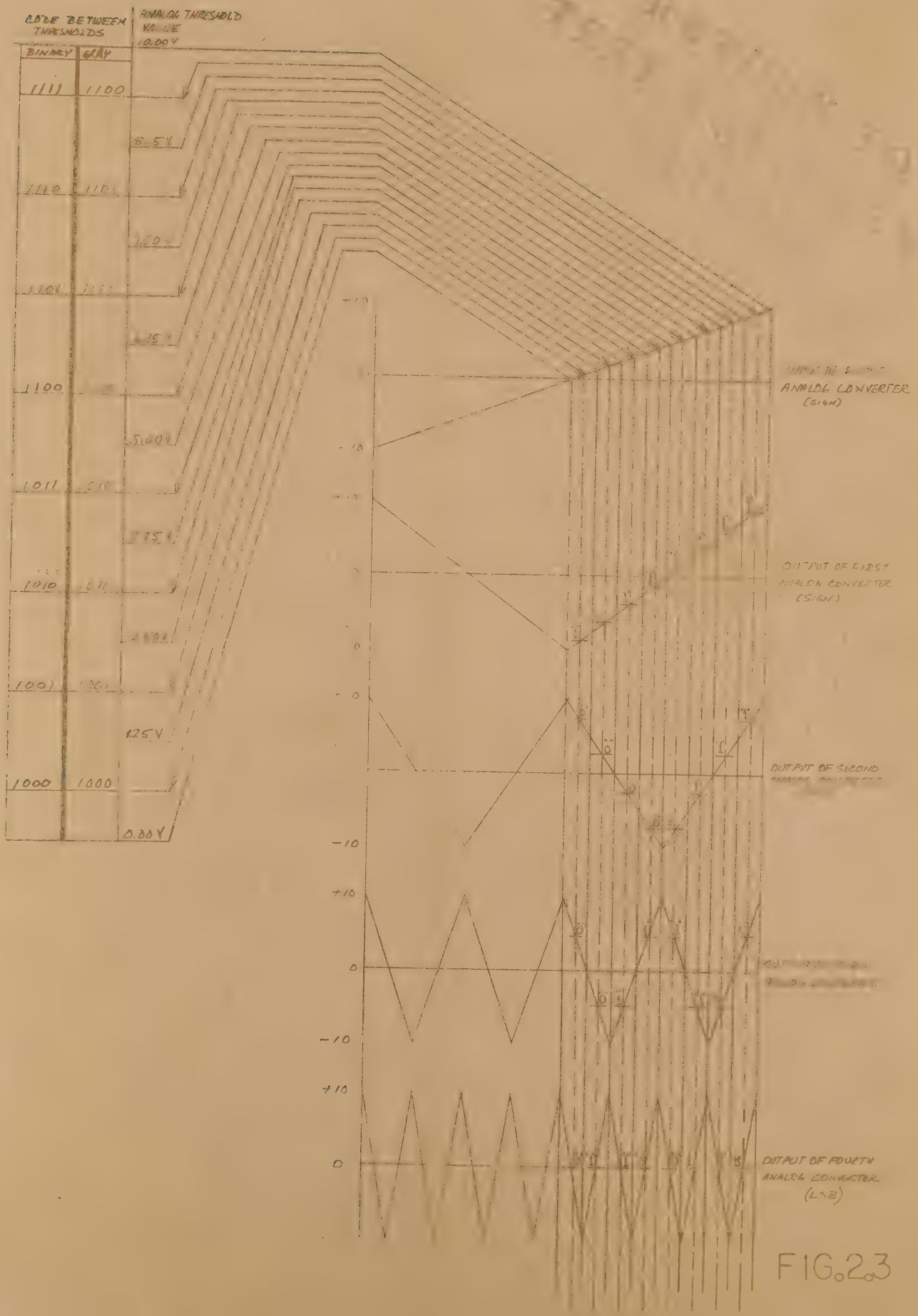

CODE BETWEEN THRESHOLDS
ANALOG THRESHOLD VALUE
10.00 V
BINARY
GRAY
1111
1100
1100
1000
0.00 V
+10
-10
0
ANALOG CONVERTER (SIGN)
OUTPUT OF FIRST ANALOG CONVERTER (SIGN)
OUTPUT OF SECOND
OUTPUT OF FOURTH ANALOG CONVERTER (LSB)

FIG. 23

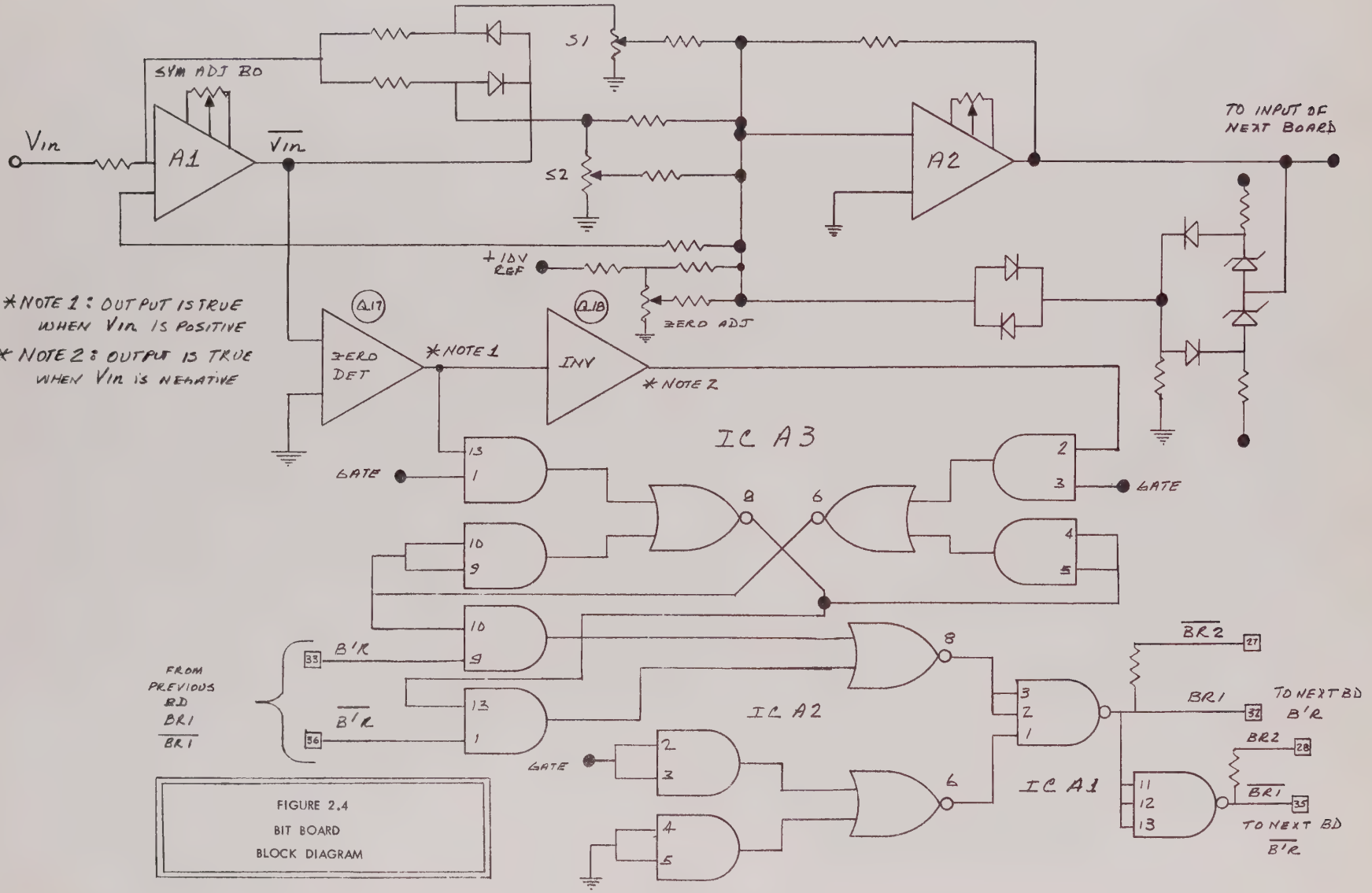


FIGURE 2.4
BIT BOARD
BLOCK DIAGRAM

2.3 SAMPLE-AND-HOLD

Figure 2.5 is a block diagram of the GM Series Sample-and-Hold Amplifier. The basic design is two amplifiers in series with a switch between the amplifiers allowing the second amplifier to be disconnected from the first amplifier on command.

The first amplifier is a differential input amplifier. This amplifier may be operated differentially or single-ended by tying one of the inputs to the ground. The use of either differential or single-ended input is dependent upon customer-specified requirements.

The second amplifier is connected as an integrating amplifier. This amplifier follows the output of the first amplifier until the sample-and-hold command switches from the sample mode to the hold mode. The acquisition time of the amplifiers is about one-half microsecond. When the command goes to "hold," the second amplifier is disconnected from the first and the signal that was last on the input of the integrating amplifier is held by the feedback capacitor. This DC signal can be held for as long as a millisecond before deterioration begins (see specifications, Section 4).

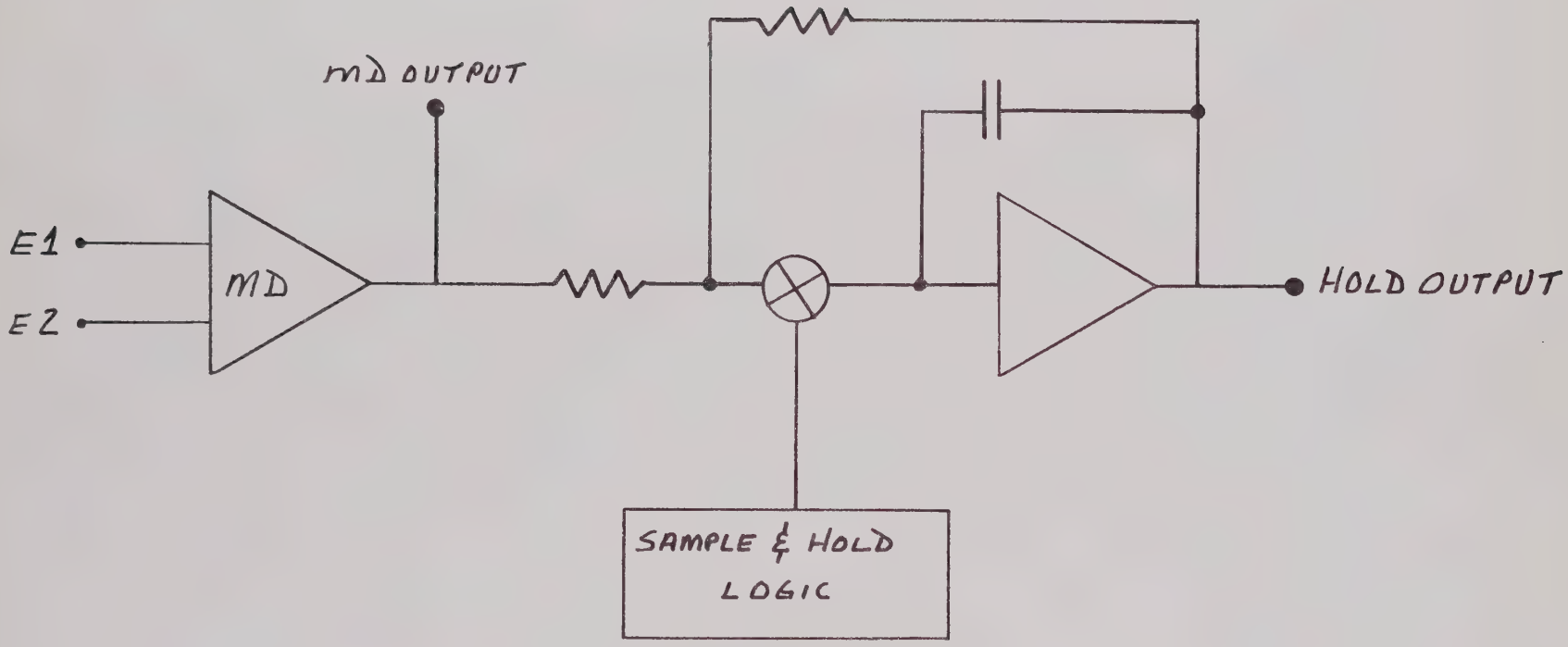


FIGURE 2.5

SECTION 3

GENERAL ADC CALIBRATION

SECTION 3

3.1 INTRODUCTION

This calibration procedure describes the step-by-step method for calibrating the GM series analog-to-digital converter. Hardware and placement of certain boards may be different depending upon each customer's requirement, but basic calibration is the same for all GM ADC's and can be adapted for each individual instrument.

Please refer to the basic assembly drawings for individual plug-in board placement. Refer to the assembly drawings for each individual board for variable resistor and capacitor placement, pin numbers, and test points.

3.2 TEST EQUIPMENT

(a) Oscilloscope

(b) Variable DC Source

(c) 5 Digit DVM

(d) Extender Board with Test Points (bit board)

(e) Extender Board with Test Point (S&H)

3.3 CALIBRATION GM ADC

In the GM ADC, with the exception of the four least significant bits, each bit is controlled by a single printed circuit board. During calibration, each board will be adjusted individually starting with the least significant bit board (excluding the bits 1, 2, 4, and 8). There are some adjustments that relate to the last four bits and these adjustments will be discussed at the end of the bit board adjustment (paragraph 3.3.3).

3.3.1 ADC

(a) Locate the least significant bit board (excluding the last four bits 1, 2, 4, and 8). It is the AMP/LOGIC board closest to the 4 bit amplifier board. [Normally bits 1, 2, 4, 8 are on two boards and are not adjusted per this procedure (see section 3.3.3). If the ADC does not contain a 4 bit amplifier board, disregard paragraph 3.3.3 and begin the procedure with the least significant bit.]

(b) Remove the AMP/LOGIC board located just prior to the one mentioned in Step (a) and replace it with the BIT BOARD EXTENDER.(*) This board may be specially made and contain test pins or wires and is designed to allow the operator to isolate a particular board and introduce an input directly into that bit board, or the operator may use a standard extender board and for replacement of bit boards use the following pin numbers for connecting the input signal.

BIT BOARD EXTENDER	LABEL
Pin #9	Input Hi
Pin # 4&5	Ground (Low)

NOTE: JUMPER PINS 38 to 35 (logic).

For extender replacement of the Sample-and-Hold board, the pin numbers are as follows:

SAMPLE-AND-HOLD EXTENDER	LABEL
Pin #22	Input Hi
Pin #16	Input Low (Gnd.)

NOTE: DO NOT JUMPER PIN 38to35 AS ABOVE.

(c) Connect the DVM to the test points marked A2 and ANA GRD located on Figure 3.5

the bit board in question. Connect the variable DC source (with monitor) to the extender board (pins 4, 5, and 9).

(d) Set the variable DC source for minus 10 millivolts and note the reading on the DVM.

(e) Set the variable DC source for plus 10 millivolts and adjust potentiometer labeled BO so that a plus 10 millivolt input produces the same reading (at A2) as minus 10 millivolts did. Switch between plus 10 millivolts and minus 10 millivolts and adjust BO until there is no change in the reading of the DVM.

(f) Set the variable DC source for 0 VDC and adjust the potentiometer labeled zero until the reading at A2 is minus 10 volts.

(g) Set the variable DC source for plus 10 volts and adjust potentiometer S2 for a plus 10.000 volt reading at test point A2.

(h) Set the variable DC source for minus 10 volts and adjust potentiometer S1 for a plus 10.000 volt reading at test point A2.

(i) Repeat paragraph number two of Step 3.1 (e) to check the symmetry.

(j) Repeat step 3.1 (f) to check the zero setting.

(k) Repeat steps 3.1 (g) and (h) to check the full scale of the bit board.

3.3.2 Subsequent Bit Board Adjustment

(a) Remove the bit board extender. Replace the bit board. Remove the next preceeding bit board and insert the bit board extender.

Repeat steps 3.3.1 (c) through 3.3.1 (k) for the bit board which has just been reinserted into the ADC.

(b) Repeat 3.3.2 (a) for all bit boards in sequence moving from the least to the most significant bit boards.

NOTE: When the most significant bit board is reached and there is a sample-and-hold or Buffer present in the preceeding slot, it will be necessary to change the Bit Board Extender to the Sample-and-Hold Extender or as indicated in step 3.3.1 (b)(*) to change the input to the pins indicated.

3.3.3 4 Bit Amplifier Calibration Figure 3.6

(a) Remove the bit board preceeding the 4 bit amp.. Place the bit board extender into the slot. Connect a triangular wave generator to the bit board extender. Set the output of the generator for a triangular wave of 20 volts peak-to-peak (symmetrical about zero, +10 to -10).

(b) View the output AMP 1 on an oscilloscope and set the symmetry B01 so that all waves viewed on the scope are symmetrical.

(c) Set the potentiometer Z1 so that the output is symmetrical about zero.

(d) Repeat Steps 3.3.3 (b) and (c) for amplifier output AMP 2 (B02 and Z2).

(e) Repeat Step 3.3.3 (b) for AMP 3 output (B03). View this at the junction of the 10K resistor and the collector of Q19.

(f) Repeat Step 3.3.3 (b) for AMP 4 output (B04). It will be necessary to monitor AMP 4 output at the junction of the 22K resistor and the collector of Q17, since there is no test point available.

(g) View the test point AMP 3 and to recheck the symmetry of AMP 3 (B03) and AMP 4 (B04)

3.4 BUFFER AMPLIFIER

3.4.1 PRELIMINARY

All GM Analog-to-Digital Converters will have either a sample-and-hold or a buffer amplifier at the input to the ADC.

The calibration of the buffer amplifier should be done after calibration of the ADC in order to allow the ADC to be used as a measuring instrument if necessary.

If there is not a multiplexer involved in the same chassis as the ADC, direct connection to the input of the buffer can be accomplished at the rear panel connector.

If a multiplexer is involved in the ADC chassis, connection to the input of the buffer may be accomplished by either of two methods:

(a) Selection of a particular multiplexer channel and removal of that channel to enable connection to the input of the buffer through the common buss line of the multiplexer.

(b) Selection of a particular multiplexer channel and removal of that channel and then placing the buffer amplifier on an extender board and connecting to the input of the buffer directly through the pins of the buffer amplifier itself.

3.4.2 COMMON MODE RTO Fig 3.7

The common mode adjustment need only be made if the buffer amplifier is to be used as a differntial input device.

When a common Mode RTO adjustment potentiometer appears on a buffer amplifier and the buffer is used as a single ended input device, the CM RTO potentiometer is to be set to the center of its span.

3.4.3 ZERO Fig 3.7

Short EI (input high) to ground and using an oscilloscope (DC) adjust the Zero potentiometer for a minimum output at the test point mounted between RTOCM and GAIN potentiometer.

3.4.4 GAIN Fig 3.7

The gain of the buffer amplifier in the GM ADC will depend upon the customer's input full scale and output code requirements.

Regardless of the input characteristics the GMADC operates on a 20 volt reference swing (+10 to -10 volts). Therefore, the gain of the buffer is adjusted to compensate for the input full scale requirements.

Also due to special requirement of the customer the buffer may be non-inverting or inverting. The methods for calibration of the gain will vary depending on these amplifying characteristics of the buffer.

3.4.4 (cont'd) (a) Non-Inverting: A gain of 1 buffer with a non-inverting output is calibrated by looking at the input and output differentially on an oscilloscope. Adjust the GAIN potentiometer until there is no difference between the input and the output of the buffer.

NOTE 1. When the non-inverting buffer gain is other than a gain of 1, it will be necessary to use a divider on the input as in Figure 3.1.

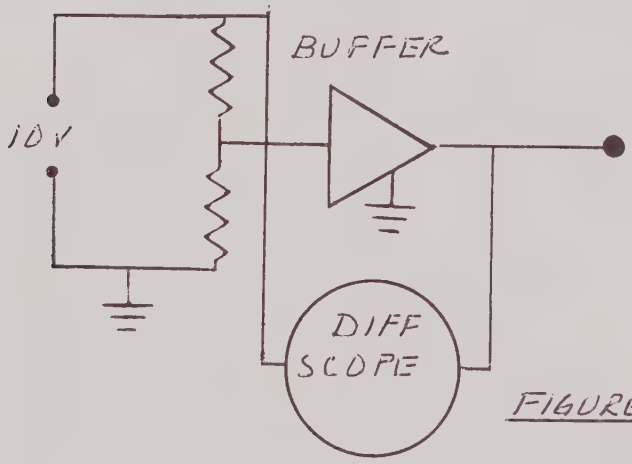


FIGURE 3.1

The input divider is selected to give an input to the buffer that will produce a full scale output. Measure the input against the output differentially on an oscilloscope and adjust the GAIN potentiometer for a null on the scope.

3.4.4 (cont'd) (b) Inverting: A gain of 1 buffer with an inverting output is calibrated by connecting the input and output per figure 3.2.

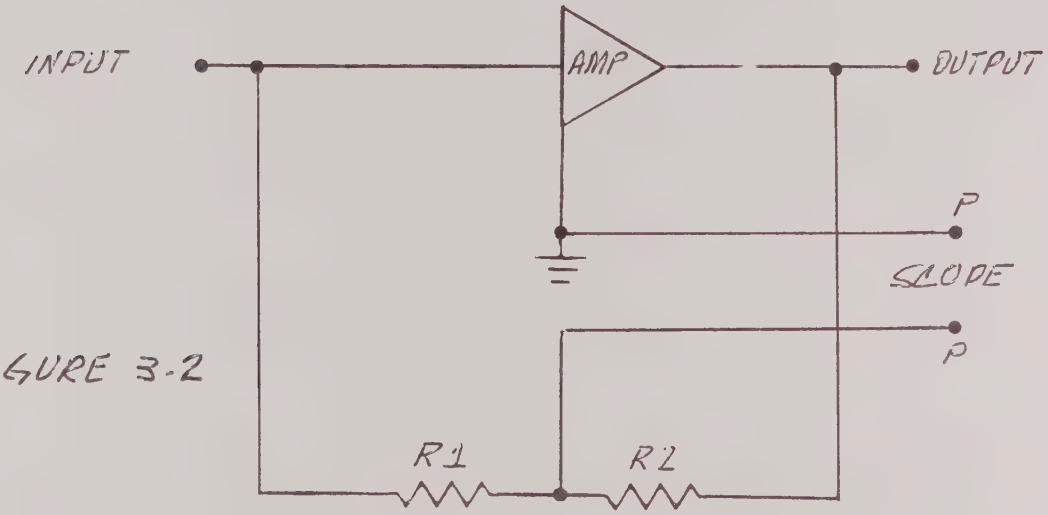


FIGURE 3.2

R1 and R2 are of equal value. Observe the output at test points P-P and adjust the gain for a minimum difference as indicated by the oscilloscope.

NOTE 2. When the inverting buffer gain is other than 1 it will be necessary to raise or lower the values of either R1 or R2 to compensate for the gain.

NOTE 3. TOTAL SYSTEMS ADJUSTMENTS

With the assumption that the ADC has been calibrated separately per the procedure in Section 3, it may be necessary to check calibration of the combination ADC-Buffer, ADC-Buffer-MUX, or ADC-S&H-MUX Assembly.

Note 3 (cont'd) With this in mind, do the following steps in order to effect a complete calibration of the GMAD System.

a) Apply a zero input to the Buffer or sample-and-hold (depending upon the system) as indicated in Section 3.4.1 or 3.5.1 and adjust the ZERO potentiometer on that board to effect a ZERO output digital code of the ADC set.

b) Using a full scale input and adjust the potentiometer of the buffer or S & H board to effect a Full Scale output digital.

The above adjustments are intended to be touch up adjustments for the system and are only valid if the ADC alone has been previously calibrated as an individual part.

RETURN TO
TEST EQUIPMENT
FILE

3.5 GM SAMPLE-AND-HOLD

3.5.1 Preliminary

The calibration of the sample-and-hold amplifier should be done after calibration of analog-to-digital converter (ADC), if applicable, in order to allow the ADC to be used as the measuring instrument. With reference to the inputs to the sample-and-hold, these inputs may be at the rear connector of the unit, which means direct connection through this connector is possible. However, if the sample-and-hold is between the multiplexer and the ADC, and not in a separate module, it will be necessary to select a MUX channel and remove that channel from the system. Then the input to the sample-and-hold can be tied to the common buss line of the multiplexer.

3.5.2 Calibration Common Mode

The common mode adjustment is necessary for all differential input sample-and-hold amplifiers. Sample-and-hold amplifiers with single-ended inputs do not require a common mode adjustment; all that is necessary is that the common mode potentiometer (RTOCM) be placed in the center of its span.

(a) Tie the input HI and LO together

(b) Apply a 5v, 60 Hz, AC signal between the tied-together HI, LO and ground

(c) Observe the output at the test point marked "SH." Place the amplifier into the sample mode and adjust the RTOCM potentiometer for a minimum output.

3.5.3 Preliminary Zero and Gain Settings

(a) Zero

Short HI and LO together and adjust the ZERO potentiometer for a minimum output at the test point "SH," with the amplifier in the sample mode.

(b) Gain

Introduce +10 volts to the input of the amplifier. Observe the test point "SH" and adjust the gain potentiometer for a +10 volt output.

3.5.4 Preliminary Jump Setting

(a) Set the oscilloscope for a 2 microsecond per centimeter sweep.

(b) Short the input to the sample-and-hold.

(c) View the output of test point "SH." Switch between sample-and-hold at a rate which will allow two complete sample-and-hold operations to be observed as indicated in Figure 3.3. Set the hold time to be longer than the sample time to differentiate the sample from the hold on the scope.

(d) Adjust the Jump potentiometer (500 ohms) until both sample-and-hold levels are settled to the same value as in Figure 3.4. A non-metal screwdriver must be used.

3.5.5 Settling Adjustment

(a) Connect the sample-and-hold amplifier to the test fixture as indicated in Figure 3.4.1.

(b) Set the hold delay (Figure 3.4.1) to 0.5 microseconds.

(c) Set the DC Level to +10 volts

(d) Observe the pattern on the oscilloscope. It should resemble Figure 3.4.2.

(e) Adjust C1 and C2 (Figure 3.4.5) until the scope pattern looks similar to Figure 3.4.3.

(f) Set the DC Level to -10 volts and adjust C1 and C2 for the optimum scope pattern described in Figure 3.4.3.

(g) Return to Step (d) and (e) in sequence and adjust C1 and C2 for an optimum scope pattern described in Figure 3.4.3.

3.5.6 Memory Adjust

(a) Set the DC Level to +10 volts

(b) Observe the pattern on the oscilloscope; it should resemble Figure 3.4.3.

(c) Adjust R4 to bring the lines as close together as possible, as indicated by Figure 3.4.4.

(d) After adjustment, the scope pattern should be less than 2 millivolts in amplitude.

3.5.7 Final Zero and Gain Settings

Repeat Steps 3.5.3.1 and 3.5.3.2

3.5.8 Final Jump Settings

Repeat Step 3.5.4.

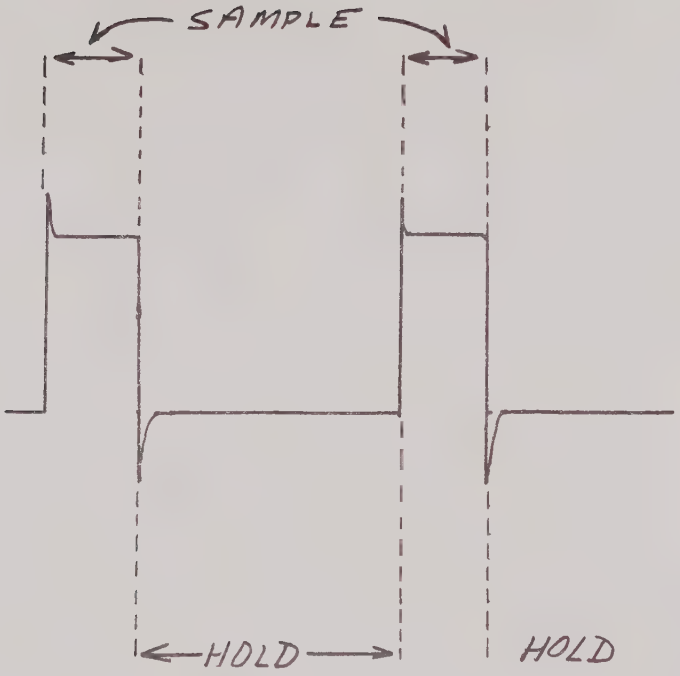


FIGURE 3.3

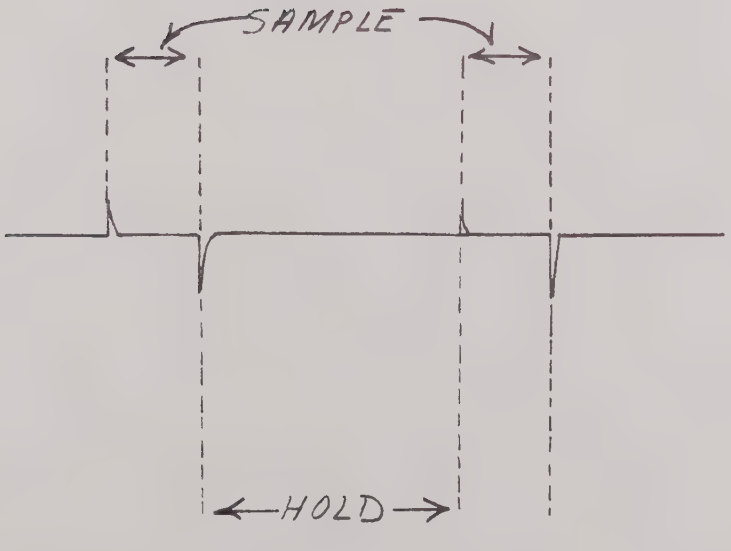


FIGURE 3.4

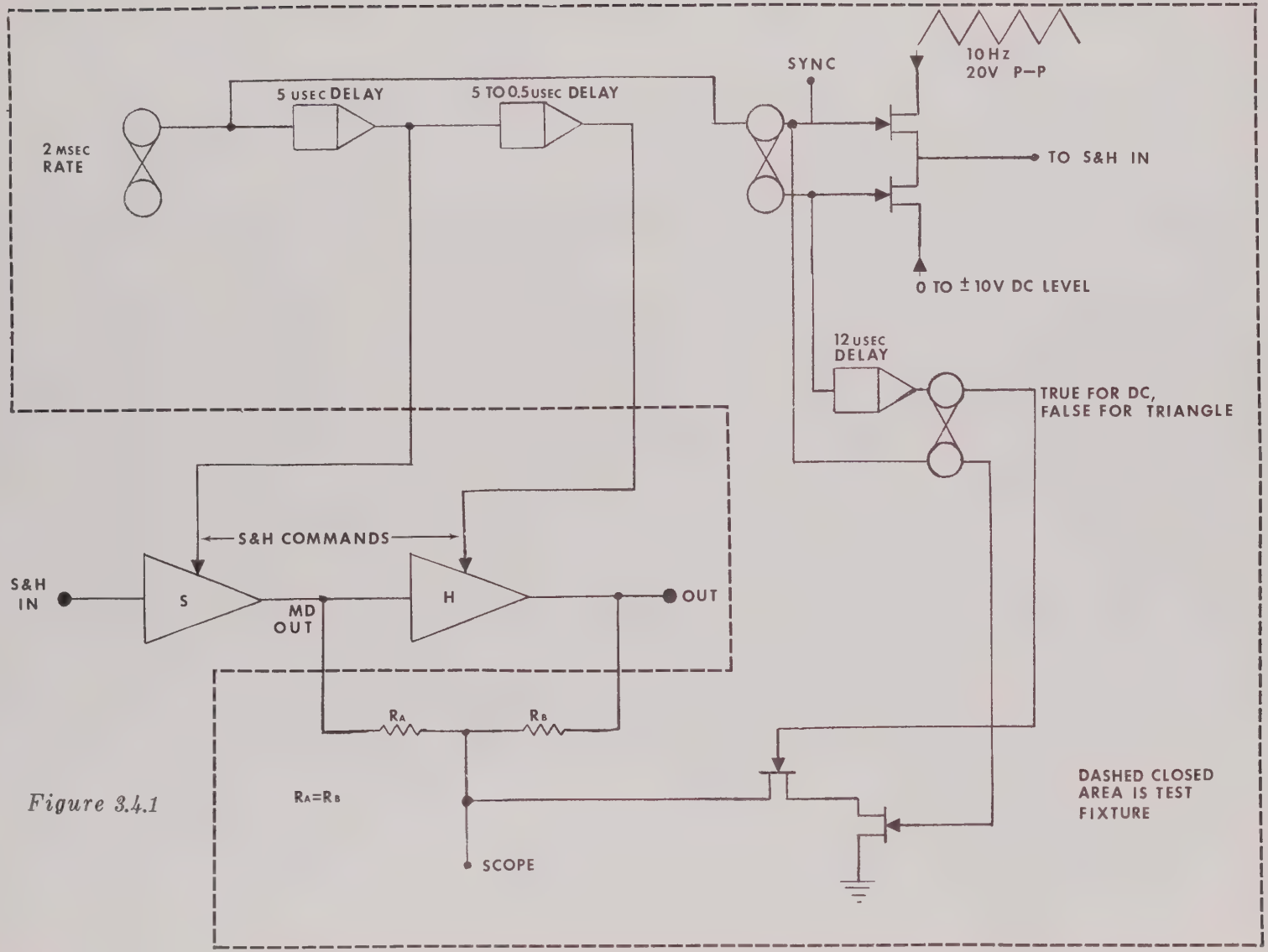

2 MSEC RATE
5 USEC DELAY
5 TO 0.5 USEC DELAY
SYNC
10 Hz 20V P-P
TO S&H IN
0 TO ± 10V DC LEVEL
12 USEC DELAY
TRUE FOR DC, FALSE FOR TRIANGLE
S&H COMMANDS
S&H IN
S
MD OUT
H
OUT
RA
RB
RA=RB
SCOPE
DASHED CLOSED AREA IS TEST FIXTURE

Figure 3.4.1

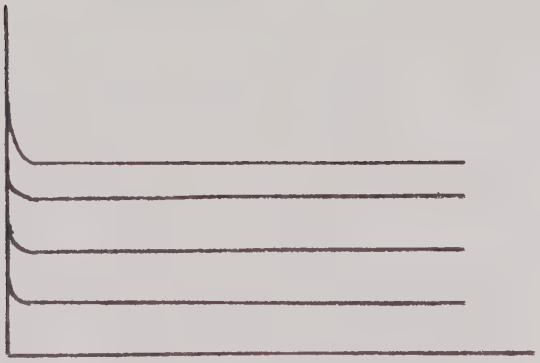


Figure 3.4.2

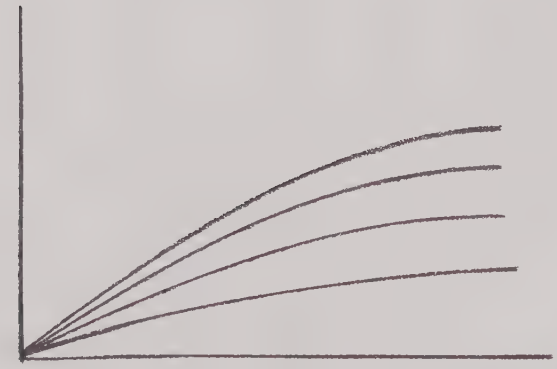


Figure 3.4.3

RETURN TO
TEST EQUIPMENT
FILE

Figure 3.4.4

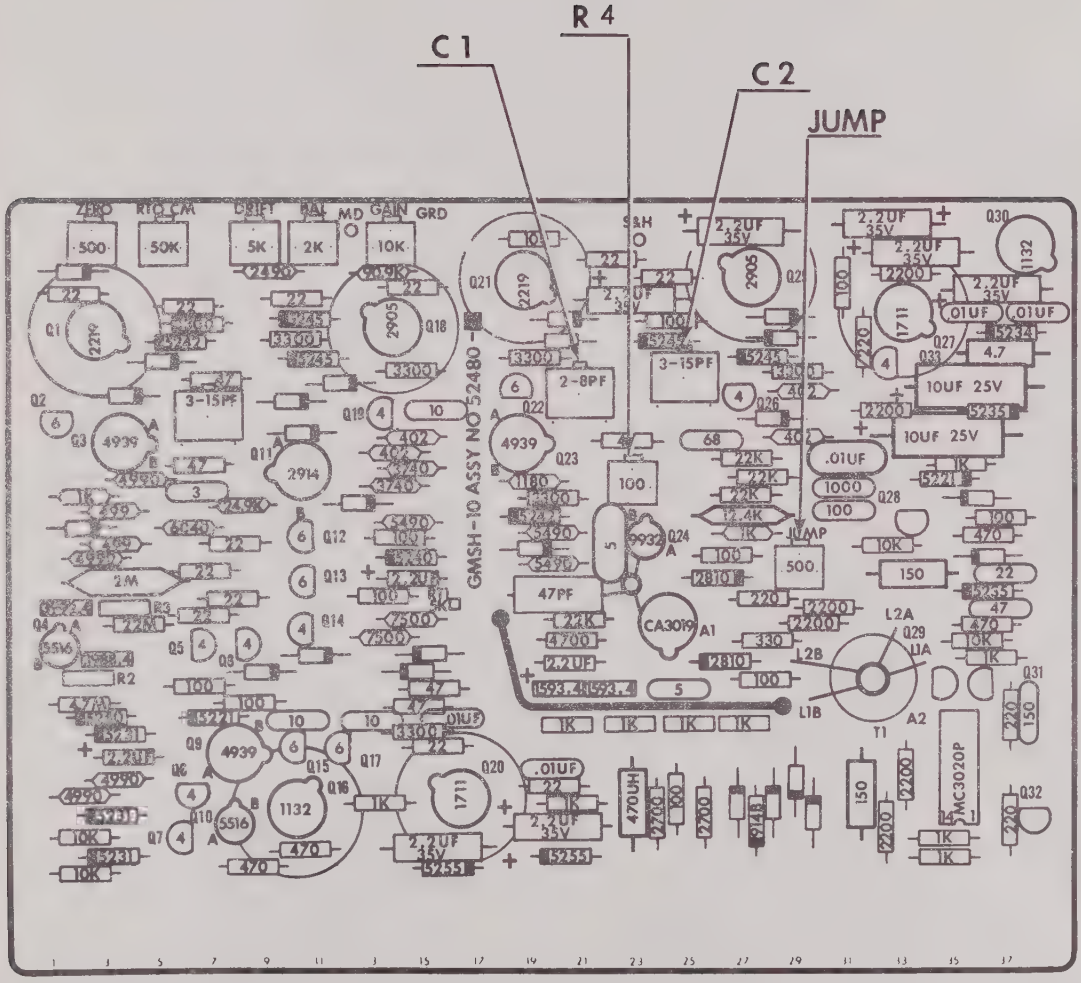
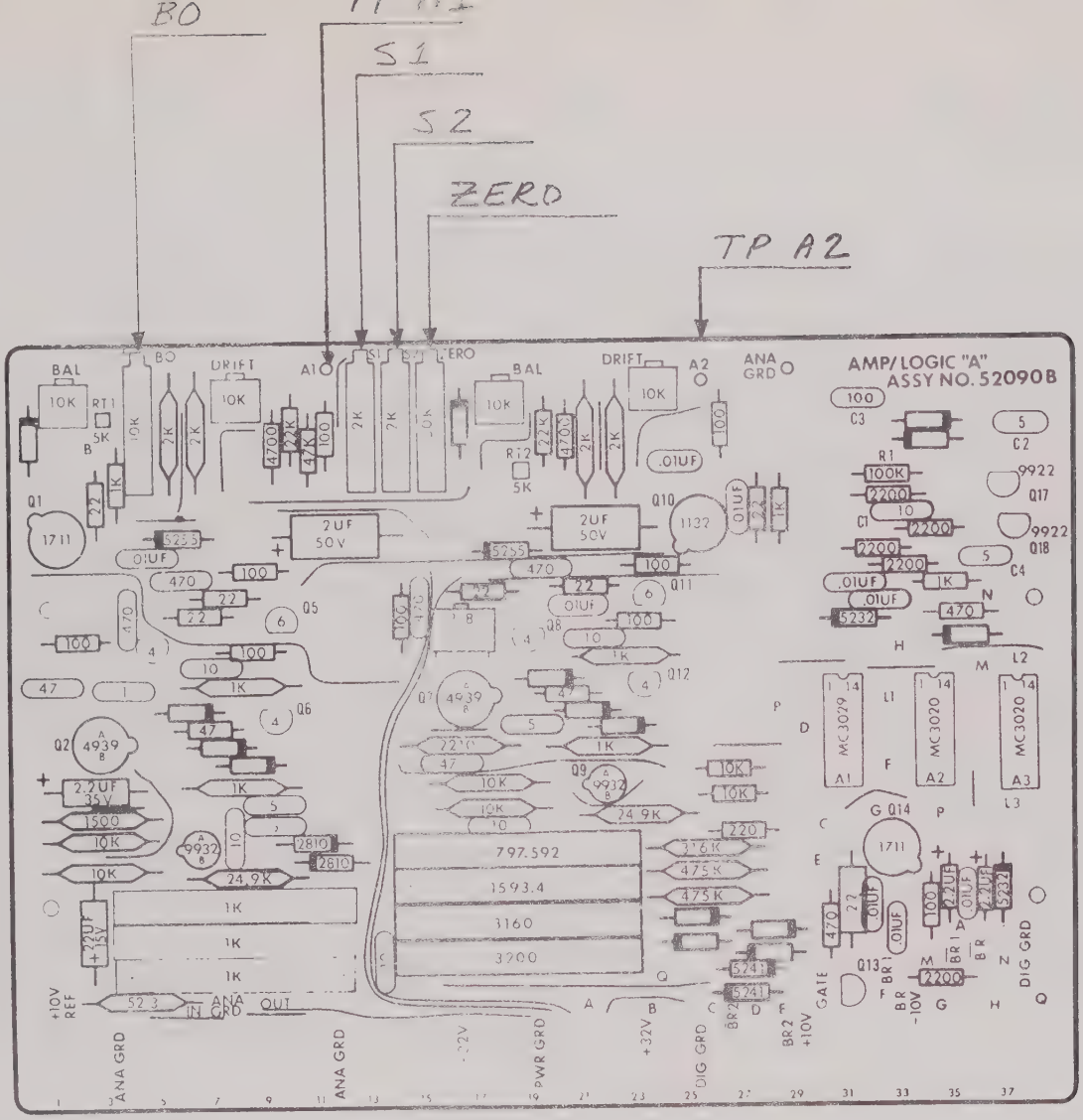

R 4
C 1
C 2
JUMP
GMSH-10 ASSY NO 52480-
ZERO
RIO CM
DRIFT
BAL
MD GAIN
GRD
S&H
2.2UF 35V
10UF 25V
.01UF
3-15PF
2-8PF
47PF
CA3019
L2A
L2B
L1B
A1
A2
T1
MC3020P

Figure 3.4.5



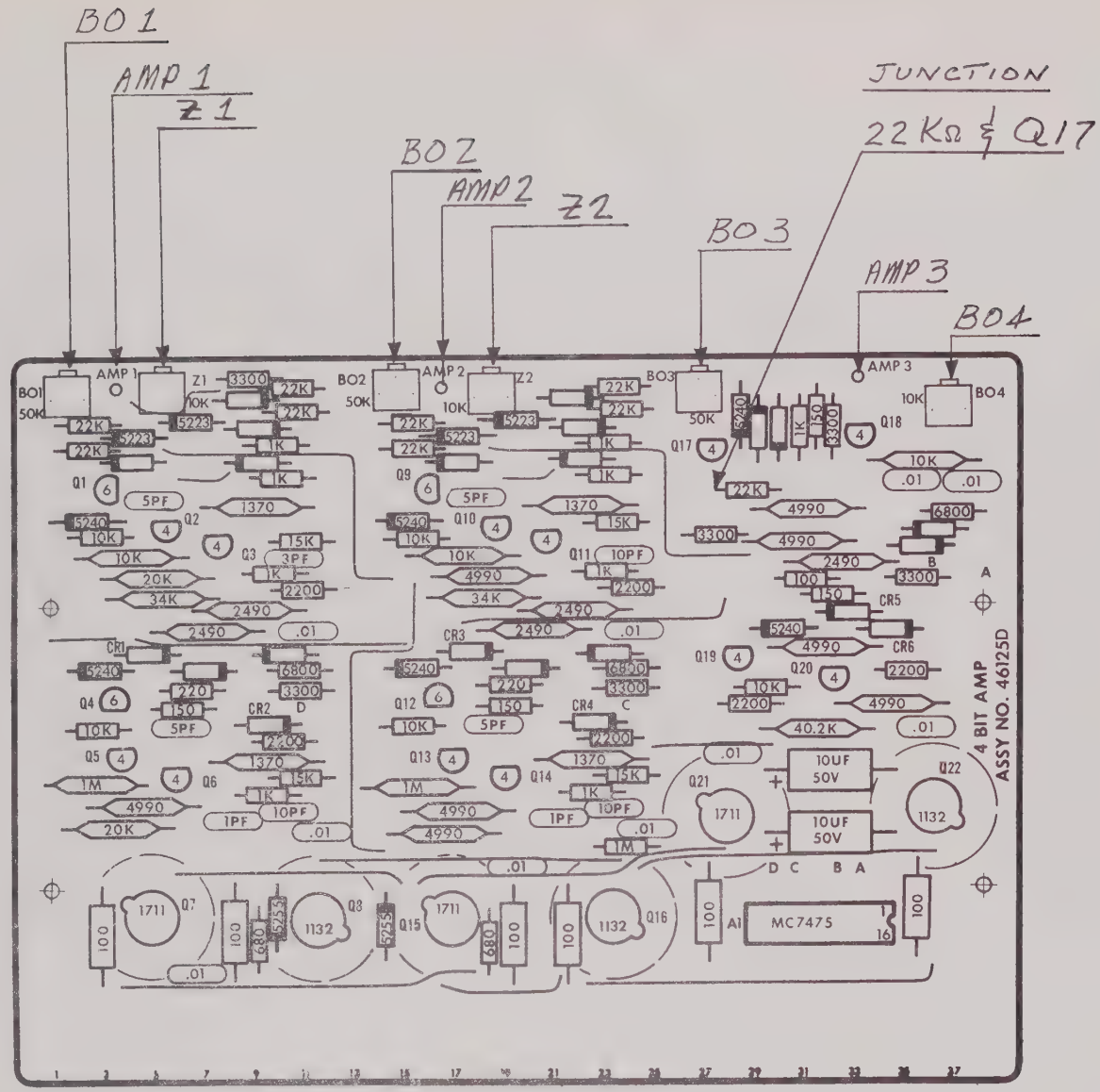
POTENTIOMETER LOCATION

CONVERTER BOARD TYPE A, B, or C

REFERENCE 3.3.1

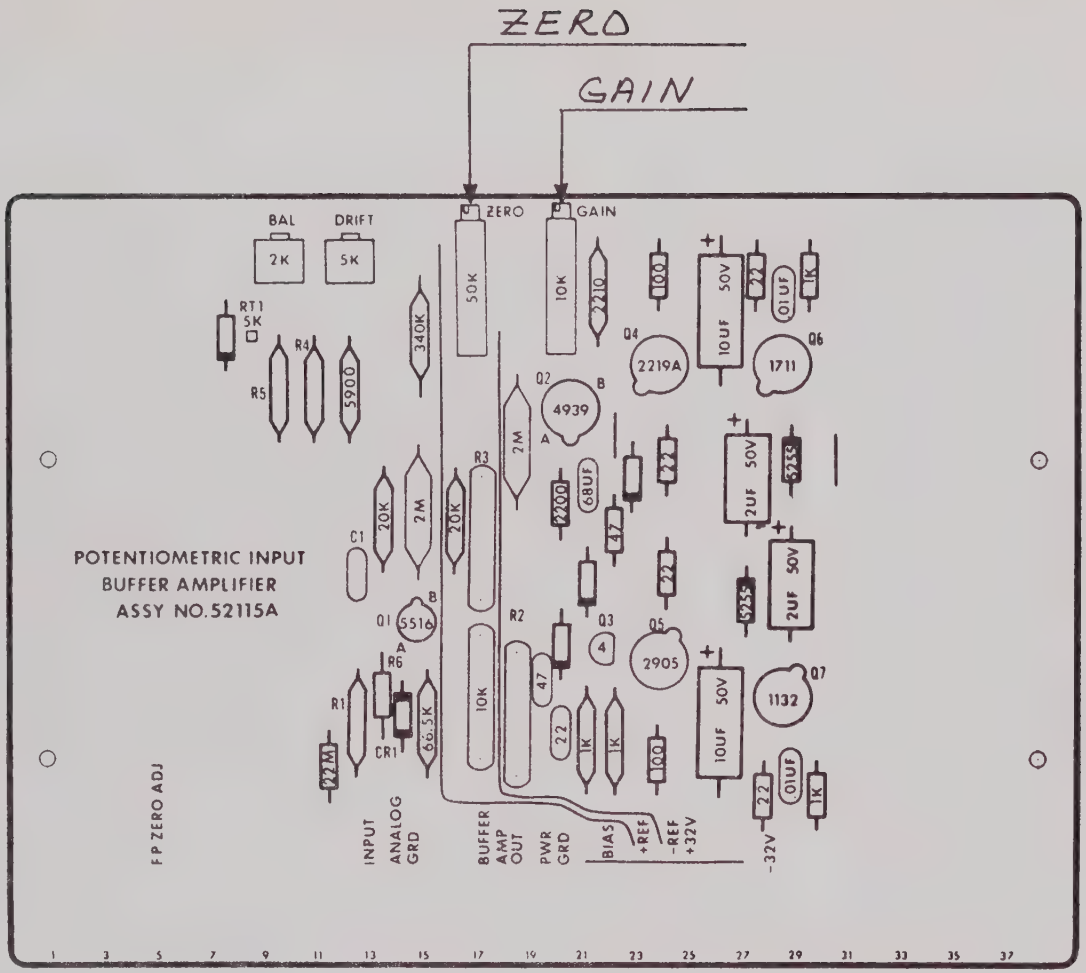
FIGURE 3.5

GMAD



4BIT AMPLIFIER
POTENTIOMETER LOCATION
REFERENCE PARAGRAPH 3.3.3
FIGURE 3.6

GMAD



POTENTIOMETER LOCATION
BUFFER AMPLIFIER
REFERENCE PARAGRAPH 3.4.3 & 3.4.4.
FIGURE 3.7

SECTION 4

SECTION 4

STANDARD SPECIFICATIONS

4.1 GMAD

4.1.1 Conversion Rates

(a) GMAD-1

14 binary bits and sign	750 kHz
13 binary bits and sign	760 kHz
12 binary bits and sign	800 kHz
11 binary bits and sign	1 MHz
10 binary bits and sign	3 MHz
9 binary bits and sign	5 MHz
8 binary bits and sign	10 MHz
7 binary bits and sign	10 MHz

(b) GMAD-2

14 binary bits and sign	200 kHz
13 binary bits and sign	225 kHz
12 binary bits and sign	250 kHz
11 binary bits and sign	275 kHz
10 binary bits and sign	300 kHz
9 binary bits and sign	400 kHz
8 binary bits and sign	500 kHz
7 binary bits and sign	750 kHz
4-digit BCD and sign	100 kHz
3-digit BCD and sign	125 kHz

(c) GMAD-3

14 binary bits and sign	100 kHz
13 binary bits and sign	110 kHz
12 binary bits and sign	125 kHz
11 binary bits and sign	150 kHz
4-digit BCD and sign	25 kHz
3-digit BCD and sign	30 kHz

4.1.2 Conversion Times

(a) GMAD-1

14 binary bits and sign	1.5 microseconds
13 binary bits and sign	1.4 microseconds
12 binary bits and sign	1.2 microseconds
11 binary bits and sign	1.0 microseconds
10 binary bits and sign	0.3 microseconds
9 binary bits and sign	0.2 microseconds
8 binary bits and sign	0.1 microseconds
7 binary bits and sign	0.1 microseconds

(b) GMAD-2

14 binary bits and sign	5 microseconds
13 binary bits and sign	4.5 microseconds
12 binary bits and sign	4 microseconds
11 binary bits and sign	3.5 microseconds
10 binary bits and sign	3 microseconds
9 binary bits and sign	2.5 microseconds
8 binary bits and sign	2 microseconds
7 binary bits and sign	1.5 microseconds
4-digit BCD and sign	10 microseconds
3-digit BCD and sign	8 microseconds

(c) GMAD-3

14 binary bits and sign	10 microseconds
13 binary bits and sign	9 microseconds
12 binary bits and sign	8 microseconds
11 binary bits and sign	7 microseconds
4-digit BCD and sign	40 microseconds
3-digit BCD and sign	32 microseconds

4.1.3 Input Impedance: 100 megohms or greater

4.1.4 Source Impedance: 1000 ohms maximum

4.1.5 Data Outputs: TTL

4.1.6 Output Codes

(a) Binary

True bipolar
One's complement
Two's complement

(b) BCD

True bipolar
Nine's complement
Ten's complement

4.1.7 Accuracy

14 binary bits and sign	±0.01% ±1/2 LSB
13 binary bits and sign	±0.015% ±1/2 LSB
12 binary bits and sign	±0.025% ±1/2 LSB
11 binary bits and sign	±0.05% ±1/2 LSB
10 binary bits and sign	±0.1% ±1/2 LSB
9 binary bits and sign	±0.2% ±1/2 LSB
8 binary bits and sign	±0.4% ±1/2 LSB
7 binary bits and sign	±0.8% ±1/2 LSB

4.1.8 Input Voltage Range

Standard ranges are from ±5 volts to ±10 volts. Other ranges are available upon special request.

4.1.9 Digitize Command

Positive or negative slope and pulse width greater than 10 nanoseconds.

4.1.10 End-of-Conversion

Parallel data ready indication; nominal pulse duration of 100 nanoseconds.

4.1.11 Power

The ADC Systems are equipped with their own integral DC power supply and require only standard line voltage (115v AC ±10%, 60 Hz).

4.2 GMM MULTIPLEXER

4.2.1 Type: Single-ended SPST

4.2.2 Channel Selection: Selection by random address, sequential or any combination of both, when the GMC Logic Control Package is employed.

4.2.3 Switching Time: Less than 1 microsecond

4.2.4 Accuracy: 0.01%

4.2.5 Input Impedance: Greater than 50 megohms

4.2.6 Crosstalk: Between channel crosstalk is less than 0.01% of full scale

4.2.7 Linearity: 0.01% of full scale

4.2.8 Zero Drift: Less than ±1.0 millivolt

4.2.9 Logic Levels: Either positive or negative true

Note: The GMM Multiplexer is used only with the GMAD-2 and GMAD-3 Converters. The GMAD-1 utilizes the GMD-1 Amplifier/Multiplexer for its multiplexing capability.

4.3 SAMPLE-AND-HOLD GMSH-10 AND GMSH-100

4.3.1 Gain: 1.000 ±0.01%

4.3.2 Gain Stability and Linearity: ±0.01% of full scale

4.3.3 Input Impedance: Greater than 100 megohms

4.3.4 Source Impedance: 0 to 1000 ohms

4.3.5 Output Impedance: Less than 1 ohm

4.3.6 Output Load: 200 ohms minimum, 500 pf maximum

4.3.7 Settling Time (acquisition time to 0.01%) Sample Modes:

(a) GMSH-10

0.5 microseconds from one full scale polarity to the opposite polarity (10 volts full scale)

(b) GMSH-100

2 microseconds from one full scale polarity to the opposite polarity (10 volts full scale)

4.3.8 Hold Delay

(a) GMSH-10: 0.25 microseconds after HOLD pulse leading edge

(b) GMSH-100: 1 microsecond after HOLD pulse leading edge

4.3.9 Hold Aperture

(a) GMSH-10: 10 nanoseconds

(b) GMSH-100: 50 nanoseconds

4.3.10 Noise: 0.5 millivolts peak

4.3.11 Droop in Hold Mode: +1 millivolt after 1 millisecond

4.4 GMD AMPLIFIER MULTIPLEXERS

4.4.1 Amplifier Type: Direct-coupled, fixed gain

4.4.2 Gain Characteristics

(a) Gain selection: The gain of the amplifier is fixed at unity (1) for the Model GMD-1, and at one-tenth (0.1) for the Model GMD-01

(b) Gain accuracy: ±0.01% of full scale

(c) Gain stability: ±0.01% of full scale for six months at the same temperature

(d) Gain temperature coefficient: Less than ±0.002% per degree C

(e) Gain trim: Permits adjustment to within 0.01%; resolution is 0.005% or better

4.4.3 DC Linearity: Maximum deviation ±0.01% of full scale

4.4.4 Zero Characteristics

(a) Zero stability: Short term, ±0.5 millivolts RTO (relative to output) for 48 hours at the same temperature

(b) Zero temperature coefficient: ±0.05 millivolts RTO per degree C

(c) Zero trim: A zero offset adjustment is provided with resolution of 0.1 millivolts

4.4.5 Input Characteristics

(a) Input impedance

4.4.5 (a) (continued)

Input resistance: 100 megohms for Model GMD-1; 100k megohms for Model GMD-01

Shunting capacitance: 100 picofarads

(b) Common mode rejection: 80 db from DC to 60 Hz

(c) Common mode voltage: 10 volts peak AC or DC

(d) Pumpout Current: 10 picoamps nominal

(e) Input connection: Requires only three wires: Input High, Input Low and Guard

(f) Input overload recovery: The amplifier will recover from an overload of five times full scale to within ±0.05% of full scale in less than 200 microseconds. Recovery time of the amplifer increases proportionately as the bandwidth decreases (i.e., at 1 kHz, recovery time is 2 milliseconds). A 20 volt normal mode overload shall not permanently damage the amplifier.

4.4.6 Output Characteristics: Commutated ±10 volts full scale

(a) Output impedance - ON: 500 ohms maximum

(b) Output leakage current - OFF: 15 nanoamps maximum

(c) Crosstalk: 0.01% of full scale maximum for 100 channels

(d) Switching time: 1 microsecond to 0.01% of full scale into a load of 10 megohms shunted by 500 pf. (Analog buss should be guarded and driven externally if wiring capacity exceeds 500 pf.)

(e) Fault condition: Any fault condition of the amplifier will not affect the operation of the multiplexer switch.

4.4.7 Frequency Characteristics

(a) Bandwidth: Less than 3 db down at 1 MHz at 10 volts peak-to-peak

(b) Optional filter: Any fixed bandwidth from 10 Hz to 1 MHz

4.4.7 (c) Settling time: 2.0 microseconds maximum to within 0.01% of final value ±10 microvolts RTI at 1 MHz. Settling time of the amplifier increases proportionately as the bandwidth decreases (i.e., at 1 kHz, settling time is 2 milliseconds).

4.4.8 Noise Characteristics

Output noise is less than 1.0 millivolts peak-to-peak; typically 0.5 millivolts peak-to-peak

4.4.9 Power Requirements

All operation and performance specifications apply for line power of 105/130 volts RMS or 220/260 volts RMS at 50 to 60 Hz. Step transients of 5% within the voltage range will not affect the amplifier. Amplifiers are powered by a common supply with a capacity of 48 amplifiers.

4.4.10 Mechanical Specifications

Forty-eight Model GMD Amplifier-Multiplexers mount in a standard, 19-inch wide relay rack, occupying 5-1/4 inches of panel height and 26 inches of rack depth. A limited number of channels may be included within the same package with the Model GMAD-2, -2 or -3 Analog-to-Digital Converter. The power supply is contained within these package dimensions.

4.5 ENVIRONMENTAL

4.5.1 Operating Temperature

The converter will perform to the specifications stated, within a temperature range of 0°C to +50°C.

4.5.2 Cooling

For proper operation, the air surrounding the converter should be maintained between 0°C and +50°C, with a relative humidity not to exceed 70%. The converter utilizes its own fan for internal cooling.

4.5.3 Storage Conditions

The converter will show no deterioration when subjected to storage temperatures of -55°C to +85°C and to relative humidities of up to 100% without condensation.

4.6 PHYSICAL

4.6.1 Size: The dimensions of the converter are 20 or 26-1/2 inches in length (total); 19 inches in width; and 5-1/4 inches in height.

4.6.2 Weight: The converter weighs 45 - 55 pounds (shipping weight is 60 - 75 pounds).

4.6.3 Mounting: The converter will mount into a standard 19-inch RETMA Rack.

RETURN TO
TEST EQUIPMENT
FILE

SECTION 5

PRINTED CIRCUIT ASSY

SIDE VIEW

AIR FLOW HOLES
PLATES, TYP
TOP & BOTTOM COVERS

REAR VIEW

NOTICE
THE CONTENT OF THIS DOCUMENT IS THE PROPERTY OF PRESTON SCIENTIFIC INCORPORATED. AUTHORIZATION TO REPRODUCE OR COPY THIS EQUIPMENT OR TO MANUFACTURE THE ARTICLES SHOWN THEREON MAY BE GRANTED ONLY BY SPECIFIC AUTHORIZATION IN WRITING AND SIGNED BY AN AUTHORIZED AGENT OF PRESTON SCIENTIFIC INCORPORATED.

D

REVISIONS

TOP VIEW

FRONT VIEW

REAR VIEW

SIDE VIEW

- AIR FLOW HOLES LOCATION TYP TOP & BOTTOM COVERS

- CARD GUIDE
- PRINTED CIRCUIT ASSY

(10) INSTALL CARD GUIDES (ITEM 8001) AS SHOWN IN DETAIL "B" WHERE APPLICABLE.
(12) INSTALL SHIELD, AS SHOWN IN DETAIL "A".
8. FOR FRONT PANEL REFERENCE DESIGNATIONS SEE DWG NO. 40312.
7. CABLE CLAMPS TO BE SELECTED IN ASSY.
6. INSULATE BARE TERMINALS.
5. FOR SHIPPING KIT SEE DWG NO 45153.
4. ALL DIMENSIONS ARE FOR REFERENCE ONLY.
3. FOR WIRE LIST SEE DWG NO 51153.
2. FOR CUSTOMER CONNECTION SEE D
1. TOP COVER (ITEM 10) REMOVED F
TOP VIEW INSTALL USING SCREW

NOTICE
THE CONTENT OF THIS DOCUMENT IS THE PROPERTY OF PRESTON SCIENTIFIC INCORPORATED. AUTHORIZATION TO REPRODUCE OR COPY THIS DOCUMENT OR TO MANUFACTURE THE ARTICLES SHOWN THEREON MAY BE GRANTED ONLY BY SPECIFIC AUTHORIZATION IN WRITING AND SIGNED BY AN AUTHORIZED AGENT OF PRESTON SCIENTIFIC INCORPORATED.

TITLE: GMAD-3 14 BITS & SIGN
DWG NO. 59550-00 REV A
SHEET 2 OF 3

PRESTON SCIENTIFIC INC.
PRINTED 2/23/73

PARTS LIST

			DESCRIPTION	
[illegible]	2	[illegible]	COVER TOP & BOTTOM	D
[illegible]	2	[illegible]	COVER SIDE RIGHT & LEFT	D
[illegible]	1	[illegible]	[illegible] REAR	D
[illegible]	1	[illegible]	PANEL REAR 2 [illegible]	[illegible]
[illegible]	4	[illegible]	SUPPORT INTERCONNECT	C
[illegible]	1	[illegible]	PLATE CONNECTOR	B
[illegible]	1	[illegible]	SHIPPING KI	[illegible]
[illegible]	1	[illegible]	FEED THRU TERMINAL ASSY	B
[illegible]	1	[illegible]	KNOB CONTROL	C
[illegible]	1	[illegible]	SWITCH	A
[illegible]	1	48085-00	P.C. ASSY POWER SUPPLY	AP
[illegible]	1	48098-00	ROUTING INTERCONNECT BLANK	C
[illegible]	1	56607-00	D&R ASSY INTERCONNECT BD A	C
[illegible]	1	51845-00	P.C. [illegible] AMP DRIVER ADC	AP
[illegible]	1	56440-00	P.C. ASSY ADC CONT & TIMING	AP
[illegible]	1	59655-00	P.C. [illegible] REFERENCE SUPPLIES	AP
[illegible]	1	56445-01	P.C. [illegible] BUFFER AMPLIFIER	AP
[illegible]	4	56620-00	P.C. [illegible] AMP/LOGIC A	AP
[illegible]	3	46016-00	P.C. [illegible] AMP/LOGIC B	AP
180	4	46023-00	P.C. ASSY AMP/LOGIC C	AP
[illegible]	1	46125-00	P.C. ASSY 4 BIT AMP	AP
[illegible]	1	46175-00	P.C. ASSY 4 BIT LOGIC	AP
[illegible]	1	48289-00	D&R ASSY [illegible]	C
250	1	182-02	CONNECTOR [illegible]	
260	1	177-00	CONNECTOR 5 PIN	
270	1	169-00	CONNECTOR 75 SOCKET	
280	75	332-00	CONTACT SOCKET	
290	1	256-04	FAN	
300	2	257-01	FINGER GUARD	
310	1	754-01	SWITCH TOGGLE	
330	1	266-01	FUSE 2AMP 3AG SLO-BLO	
340	1	274-00	FUSEHOLDER	
350	1	756-02	SWITCH PUSHBUTTON	
370	1	31818-00	BUSHING	B
390	1	12018-01	SHAFT EXTENDER	B
400	1	12027-00	BRACE SINGLE POTENTIOMETER	B
410	1	362-00	POTENTIOMETER 50K	
420	1	972-01	CHASSIS SLIDE	
430	16	40461-00	LENS LAMP	C
433	16	43-05	PUSHNUT	
440	16	51839-00	THERMOCAP	A
470	A/R	997-07	WIRE 18 AWG WHITE	
480	A/R	997-00	WIRE 22 AWG WHITE	
490	A/R	989-00	WIRE 22 AWG	
500	A/R	949-00	TUBING	
510	A/R	993-20	CABLE RG174/U	
520	A/R	994-05	WIRE 22 AWG BLACK/WHITE	
528	12	659-00	SCREW PHMS 2-56 X 5/16	
530	2	655-02	SCREW SET 4-40 X 1/8	
535	2	672-00	SCREW PHMS 4-40 X 1	

PARTS LIST

		PART NO.	DESCRIPTION
[illegible]	[illegible]	668-00	SCREW PHMS 4-40 X 1/2
550	24	666-00	SCREW PHMS 4-40 X 3/8
560	6	665-00	SCREW PHMS 4-40 X 5/16
565	4	624-00	SCREW FILL 4-40 X 3/8
570	24	641-00	SCREW FHMS 6-32 X 3/8
580	2	675-00	SCREW PHMS 6-32 X 3/8
590	8	679-00	SCREW PHMS 6-32 X 3/4
600	4	724-00	SCREW HEX HD 10-32 X 3/8
610	4	701-05	SCREW BUT 10-32 X 1/2
620	36	874-00	WASHER LOCK #4
630	1	863-00	WASHER E.T. #6
650	8	869-00	WASHER FLAT #6 STD
660	66	855-00	WASHER FLAT #4 SM
[illegible]	[illegible]	854-00	WASHER FLAT #6 SM
[illegible]	[illegible]	872-00	WASHER FLAT #10
[illegible]	[illegible]	851-00	WASHER I.T. 3/8
[illegible]	[illegible]	318-01	NUT 4-40
[illegible]	[illegible]	296-00	NUT LOCK 4-40
[illegible]	[illegible]	297-00	NUT LOCK 6-32
[illegible]	[illegible]	299-00	NUT LOCK 10-32
[illegible]	4	794-00	LUG CRIMP
[illegible]	[illegible]	261-14	FERRULE TERMASHIELD
[illegible]	[illegible]	262-00	FERRULE
[illegible]	[illegible]	734-08	SPACER #4 X 3/4
[illegible]	[illegible]	46020-00	SHIELD COMPONENT SIDE
[illegible]	[illegible]	46021-00	SHIELD CIRCUIT SIDE
[illegible]	[illegible]	40341-00	GUIDE CARD
[illegible]	[illegible]	145-02	CAPACITOR 50UF 50V

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

NOTICE

THE CONTENT OF THIS DOCUMENT IS THE PROPERTY OF PRESTON SCIENTIFIC INCORPORATED. AUTHORIZATION TO REPRODUCE OR COPY THIS DOCUMENT OR TO MANUFACTURE THE ARTICLES SHOWN THEREIN MAY BE GRANTED ONLY BY SPECIFIC AUTHORIZATION IN WRITING AND SIGNED BY AN AUTHORIZED AGENT OF PRESTON SCIENTIFIC INCORPORATED.

BY	DATE
DRAWN	
CHK	
ENGR	
APPD	
MFG	

TITLE: F LATTER PIPE

MATERIAL

FINISH

SCALE

A

SIZE

PRESTON

SCIENTIFIC INCORPORATED

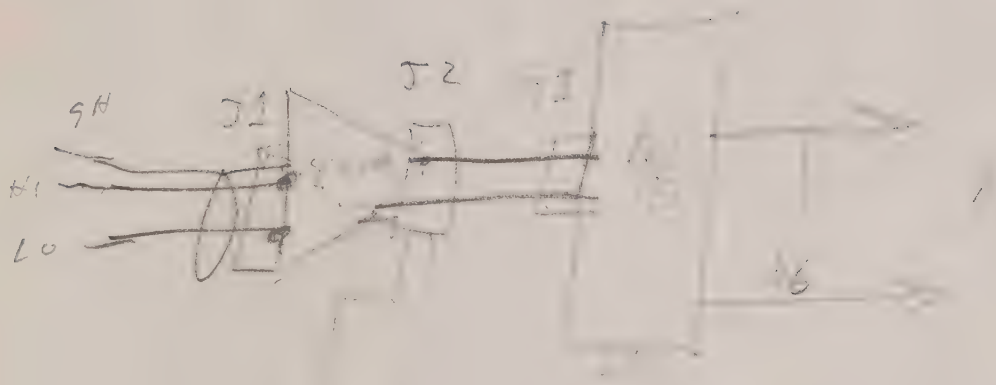
CODE

SH OF

CONNECTOR LIST

SIGNAL-PLUG-PIN#				NOTES
	CUSTOMER CONNECTION AND INTERFACE			
	GMAD-3 ANALOG TO DIGITAL CONVERTER			
	J1 ANALOG INPUTS MS3102A-14-5S			
ANAIN +	J1	A	ANALOG INPUT +	
ANAIN + SH	J1	B	ANALOG INPUT + SHIELD	
BLANK	J1	C	BLANK	
BLANK	J1	D	BLANK	
ANAGRD	J1	E	ANALOG GROUND	
	J2 DIGITAL INPUT/OUTPUT & CONTROLS MRAC 75S-J6			
DB +	J2	01	DATA BIT + SIGN	
DB + SH	J2	08	DATA BIT + SIGN	SHIELD
DB -	J2	02	DATA BIT - SIGN	
DB - SH	J2	10	DATA BIT - SIGN	SHIELD
DB 8192	J2	03	DATA BIT 8192	
DB 8192 SH	J2	11	DATA BIT 8192	SHIELD
DB 8192 *	J2	04	DATA BIT 8192COMP	
DB 8192 SH*	J2	12	DATA BIT 8192COMP	SHIELD
DB 4096	J2	05	DATA BIT 4096	
DB 4096 SH	J2	13	DATA BIT 4096	SHIELD
DB 4096 *	J2	07	DATA BIT 4096COMP	
DB 4096 SH*	J2	14	DATA BIT 4096COMP	SHIELD
DB 2048	J2	15	DATA BIT 2048	
DB 2048 SH	J2	22	DATA BIT 2048	SHIELD
DB 2048 *	J2	16	DATA BIT 2048COMP	
DB 2048 SH*	J2	23	DATA BIT 2048COMP	SHIELD
DB 1024	J2	17	DATA BIT 1024	
DB 1024 SH	J2	24	DATA BIT 1024	SHIELD
DB 1024 *	J2	18	DATA BIT 1024COMP	
DB 1024 SH*	J2	25	DATA BIT 1024COMP	SHIELD
DB 512	J2	20	DATA BIT 512	
DB 512 SH	J2	26	DATA BIT 512	SHIELD
DB 512 *	J2	21	DATA BIT 512COMP	
DB 512 SH*	J2	27	DATA BIT 512COMP	SHIELD
DB 256	J2	28	DATA BIT 256	
DB 256 SH	J2	34	DATA BIT 256	SHIELD
DB 256 *	J2	29	DATA BIT 256COMP	
DB 256 SH*	J2	35	DATA BIT 256COMP	SHIELD
DB 128	J2	30	DATA BIT 128	
DB 128 SH	J2	36	DATA BIT 128	SHIELD
DB 128 *	J2	31	DATA BIT 128COMP	
DB 128 SH*	J2	37	DATA BIT 128COMP	SHIELD
DB 64	J2	32	DATA BIT 64	
DB 64 SH	J2	38	DATA BIT 64	SHIELD
DB 64 *	J2	33	DATA BIT 64COMP	
DB 64 SH*	J2	39	DATA BIT 64COMP	SHIELD
DB 32	J2	40	DATA BIT 32	

CONNECTOR LIST



	SIGNAL	FROM PLUG	PIN	TO	PLUG	PIN	NOTES
	DB	32	SH	J2	46	DATA BIT 32	SHIELD
	DB	32	*	J2	41	DATA BIT 32COMP	
	DB	32	SH*	J2	47	DATA BIT 32COMP	SHIELD
	DB	16		J2	42	DATA BIT 16	
	DB	16	SH	J2	48	DATA BIT 16	SHIELD
	DB	16	*	J2	43	DATA BIT 16COMP	
	DB	16	SH*	J2	49	DATA BIT 16COMP	SHIELD
	DB	8		J2	44	DATA BIT 8	
	DB	8	SH	J2	50	DATA BIT 8	SHIELD
	DB	8	*	J2	45	DATA BIT 8COMP	
	DB	8	SH*	J2	51	DATA BIT 8COMP	SHIELD
	DB	4		J2	52	DATA BIT 4	
	DB	4	SH	J2	58	DATA BIT 4	SHIELD
	DB	4	*	J2	53	DATA BIT 4COMP	
	DB	4	SH*	J2	59	DATA BIT 4COMP	SHIELD
	DB	2		J2	54	DATA BIT 2	
	DB	2	SH	J2	60	DATA BIT 2	SHIELD
	DB	2	*	J2	55	DATA BIT 2COMP	
	DB	2	SH*	J2	62	DATA BIT 2COMP	SHIELD
	DB	1		J2	56	DATA BIT 1	
	DB	1	SH	J2	63	DATA BIT 1	SHIELD
	DB	1	*	J2	57	DATA BIT 1COMP	
	DB	1	SH*	J2	64	DATA BIT 1COMP	SHIELD
1	NORM MODE			J2	72	NORMAL MODE	
	TADC			J2	74	START CONVERSION	
	TADC		SH	J2	80	START CONVERSION	SHIELD
	EOC			J2	75	END OF CONVERSION	
	EOC		SH	J2	82	END OF CONVERSION	SHIELD
3	* MEANS THE COMPLEMENT						

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

NOTICE

THE CONTENT OF THIS DOCUMENT IS THE PROPERTY OF PRESTON SCIENTIFIC INCORPORATED. AUTHORIZATION TO REPRODUCE OR COPY THIS DOCUMENT OR TO MANUFACTURE THE ARTICLES SHOWN THEREIN MAY BE GRANTED ONLY BY SPECIFIC AUTHORIZATION IN WRITING AND SIGNED BY AN AUTHORIZED AGENT OF PRESTON SCIENTIFIC INCORPORATED.

BY	DATE
DRAWN	
CHK	
ENGR	
APPD	
APPD	

TITLE

MATERIAL

FINISH

SCALE

A

SIZE

PRESTON

SCIENTIFIC INCORPORATED

CODE

SH 1 OF 1

SIGNAL-PLUG-PIN:	SIGNAL-PLUG-PIN:	NOTES

WIRE LIST GMAD-3
GMADC
14 BITS & SIGN,
2'S COMPLEMENT

UNLESS OTHERWISE SPECIFIED
ALL WIRE TO BE 22 AWG

NOTE 1 18 AWG
NOTE 2 RG 174/U
NOTE 3 TWO CONDUCTOR TWISTED SHIELDED 24 AWG
NOTE 4 TWISTED PAIR BLK & WHT
NOTE 5 22 AWG BUSS WIRE WITH TEFLON SLEEVING
NOTE BETWEEN TERMINALS
NOTE 6 SWITCH S01, SEE DWG 46032
NOTE 7 FOR FRONT PANEL REFERENCE DESIGNATIONS
NOTE SEE DWG 46112
NOTE 8 FOR AC POWER WIRING SEE DWG 48086
NOTE 9 * INDICATES THE COMPLEMENT OUTPUT
NOTE10 3 CONDUCTOR TWISTED SHIELDED

CONNECT 2 18 AWG WIRES FROM GRD POST ON
REAR CONNECTOR PLATE TO A02 21

CONNECTOR J1 ANALOG INPUTS

ANAIN +	J1	A BUF HI	A03 13	NOTE 2
ANAIN + SH	J1	B BUF HISH	A03 11	NOTE 2
BLANK	J1	C BLANK		
BLANK	J1	D BLANK		
ANAGRD	J1	E ANAGRD	A02 12	NOTE 1

CONNECTOR J2 DIGITAL INPUT/OUTPUTS &
CONTROLS

DBSIGN+	J2 01	ADSIGN +	A04 28	NOTE 2
DBSIGN+ SH	J2 08	ADSIGN +SH	A04 26	NOTE 2
DBSIGN-	J2 02	ADSIGN -	A04 27	NOTE 2
DBSIGN- SH	J2 10	ADSIGN -SH	A04 26	NOTE 2
DB 8192	J2 03	ADC 8192	A05 28	NOTE 2
DB 8192 SH	J2 11	ADC 8192SH	A05 26	NOTE 2
DB 8192 *	J2 04	ADC 8192 *A	A05 27	NOTE 2
DB 8192 SH*	J2 12	ADC 8192SH*	A05 26	NOTE 2
DB 4096	J2 05	ADC 4096	A06 28	NOTE 2
DB 4096 SH	J2 13	ADC 4096SH	A06 26	NOTE 2

	SIGNAL-PLUG-PIN:				SIGNAL-PLUG-PIN:				NOTES
DB	4096	*	J2	07	ADC	4096	*A06	27	NOTE 2
DB	4096	SH*	J2	14	ADC	4096SH*	A06	26	NOTE 2
DB	2048		J2	15	ADC	2048	A07	28	NOTE 2
DB	2048	SH	J2	22	ADC	2048SH	A07	26	NOTE 2
DB	2048	*	J2	16	ADC	2048	*A07	27	NOTE 2
DB	2048	SH*	J2	23	ADC	2048SH*	A07	26	NOTE 2
DB	1024		J2	17	ADC	1024	A08	28	NOTE 2
DB	1024	SH	J2	24	ADC	1024SH	A08	26	NOTE 2
DB	1024	*	J2	18	ADC	1024	*A08	27	NOTE 2
DB	1024	SH*	J2	25	ADC	1024SH*	A08	26	NOTE 2
DB	512		J2	20	ADC	512	A09	28	NOTE 2
DB	512	SH	J2	26	ADC	512SH	A09	26	NOTE 2
DB	512	*	J2	21	ADC	512	*A09	27	NOTE 2
DB	512	SH*	J2	27	ADC	512SH*	A09	26	NOTE 2
DB	256		J2	28	ADC	256	A10	28	NOTE 2
DB	256	SH	J2	34	ADC	256SH	A10	26	NOTE 2
DB	256	*	J2	29	ADC	256	*A10	27	NOTE 2
DB	256	SH*	J2	35	ADC	256SH*	A10	26	NOTE 2
DB	128		J2	30	ADC	128	A11	28	NOTE 2
DB	128	SH	J2	36	ADC	128SH	A11	26	NOTE 2
DB	128	*	J2	31	ADC	128	*A11	27	NOTE 2
DB	128	SH*	J2	37	ADC	128SH*	A11	26	NOTE 2
DB	64		J2	32	ADC	64	A12	28	NOTE 2
DB	64	SH	J2	38	ADC	64SH	A12	26	NOTE 2
DB	64	*	J2	33	ADC	64	*A12	27	NOTE 2
DB	64	SH*	J2	39	ADC	64SH*	A12	26	NOTE 2
DB	32		J2	40	ADC	32	A13	28	NOTE 2
DB	32	SH	J2	46	ADC	32SH	A13	26	NOTE 2
DB	32	*	J2	41	ADC	32	*A13	27	NOTE 2
DB	32	SH*	J2	47	ADC	32SH*	A13	26	NOTE 2
DB	16		J2	42	ADC	16	A14	28	NOTE 2
DB	16	SH	J2	48	ADC	16SH	A14	26	NOTE 2
DB	16	*	J2	43	ADC	16	*A14	27	NOTE 2
DB	16	SH*	J2	49	ADC	16SH*	A14	26	NOTE 2
DB	08		J2	44	ADC	08	A16	03	NOTE 2
DB	08	SH	J2	50	ADC	08SH	A16	04	NOTE 2
DB	08	*	J2	45	ADC	08	*A16	07	NOTE 2
DB	08	SH*	J2	51	ADC	08SH*	A16	04	NOTE 2
DB	04		J2	52	ADC	04	A16	08	NOTE 2
DB	04	SH	J2	58	ADC	04SH	A16	09	NOTE 2
DB	04	*	J2	53	ADC	04	*A16	12	NOTE 2
DB	04	SH*	J2	59	ADC	04SH*	A16	09	NOTE 2
DB	02		J2	54	ADC	02	A16	13	NOTE 2
DB	02	SH	J2	60	ADC	02SH	A16	14	NOTE 2
DB	02	*	J2	55	ADC	02	*A16	17	NOTE 2
DB	02	SH*	J2	62	ADC	02SH*	A16	14	NOTE 2
DB	01		J2	56	ADC	01	A16	22	NOTE 2
DB	01	SH	J2	63	ADC	01SH	A16	20	NOTE 2
DB	01	*	J2	57	ADC	01	*A16	18	NOTE 2
DB	01	SH*	J2	64	ADC	01SH*	A16	20	NOTE 2

SIGNAL-PLUG-PIN:	SIGNAL-PLUG-PIN:	NOTES
XFMR SHLD J2 65	XFMR SHLD C12 17	NOTE 1
NORM MODE J2 72	NORM MODE S01 A6	
TADC J2 74	TADC A01 02	NOTE 2
TADC SH J2 80	TADC SH A01 38	NOTE 2
EOC J2 75	EOC A01 24	NOTE 2
EOC SH J2 82	EOC SH A01 38	NOTE 2

ADC FRONT PANEL WIRING

SWITCH S01 WIRING

STRAP THE FOLLOWING TERMINALS ON S01
SEE NOTES 5,6,& 7

S01 A2
S01 A3
S01 B2
S01 B3
S01 D1
S01 D3
S01 F1
S01 F2
S01 F2 GRD A01 38

EXT MODE	S01 B6 EXT MODE	A01 03
INT MODE	S01 D6 INT MODE	A01 07
MAN MODE	S01 F6 MAN MODE	A01 06

SWITCH S02 WIRING

MAN PBMODE S02 C	MAN PBMODE	A01 05
MAN PBMODE S02 NO	MAN PBMODE	A01 04
MAN PBMODE S02 NC	GRD	A01 09

R01 WIRING

ADC ZERO	R01 CW +10V REF	A02 18
ADC ZERO	R01CCW -10V REF	A02 16
ADC ZERO	R01 C S&H ZERO	A03 05

LDI LAMP BOARD WIRING

01 LD1 46 01 A16 21 NOTE 7

SIGNAL-PLUG-PIN:	SIGNAL-PLUG-PIN:	NOTES
02 LD1 43	02	A16 16 NOTE 7
04 LD1 40	04	A16 11 NOTE 7
08 LD1 37	08	A16 06 NOTE 7
16 LD1 34	16	A14 35 NOTE 7
32 LD1 31	32	A13 35 NOTE 7
64 LD1 28	64	A12 35 NOTE 7
128 LD1 25	128	A11 35 NOTE 7
256 LD1 22	256	A10 35 NOTE 7
512 LD1 19	512	A09 35 NOTE 7
1024 LD1 16	1024	A08 35 NOTE 7
2048 LD1 13	2048	A07 35 NOTE 7
4096 LD1 10	4096	A06 35 NOTE 7
8192 LD1 07	8192	A05 35 NOTE 7
+ SIGN LD1 01	+ SIGN	A04 35 NOTE 7
- SIGN LD1 04	- SIGN	A04 32 NOTE 7
+175V LD1 49	+ 175V	C12 05 NOTE 7
-10 V LD1 51	- 10V	C12 04 NOTE 7
GRD LD1 50	GRD	C12 11 NOTE 7

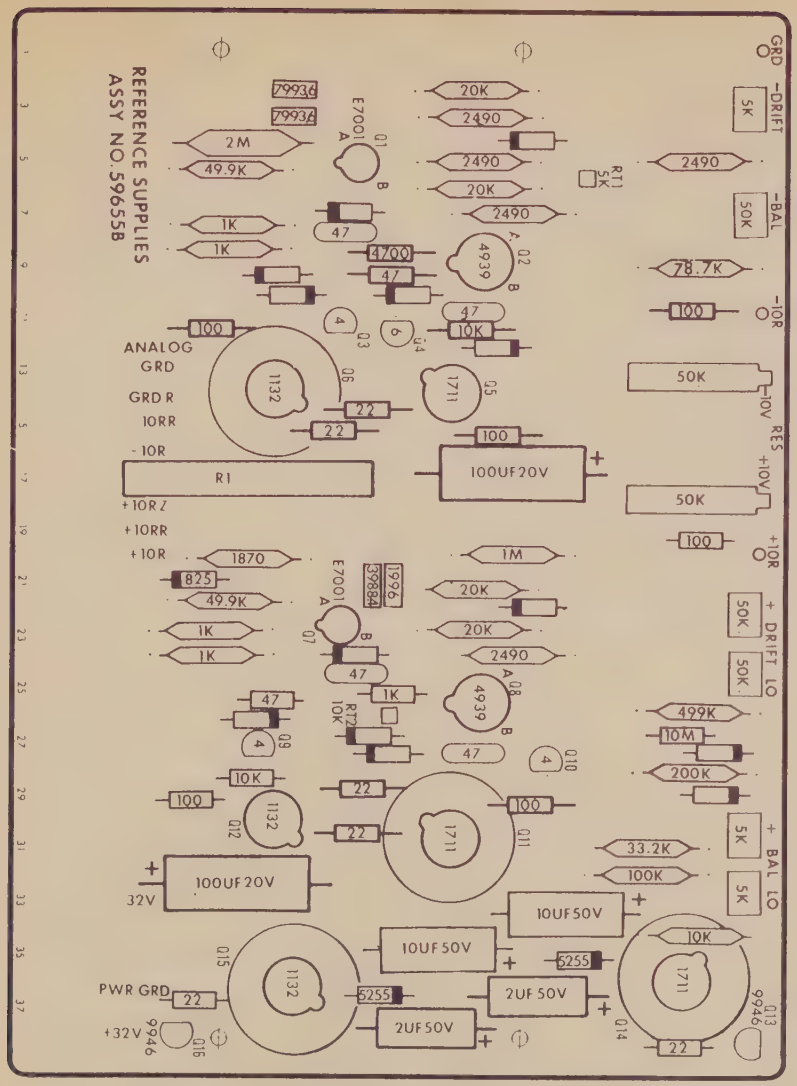
INTERCONNECT BOARD WIRING ADC

+10V A01 11	+10V	C12 09 NOTE 1
+10V A03 29	+10V	C12 09 NOTE 1
-10V A03 38	-10V	C12 04 NOTE 1
-10V A04 34	-10V	C12 04 NOTE 1
+33V A02 38	+33V	C12 12 NOTE 1
-33V A02 30	-33V	C12 13 NOTE 1
GRD PWR C12 11	GRD	A02 21 NOTE 1
GRD PWR C12 11	GRD	A02 37 NOTE 1
BUF OUT A03 22	DB SIGNIN	A04 06 NOTE 2
BUF OUT SH A03 20	DBSIGNINSH	A04 05 NOTE 2
ANA GRD A04 07	TIE TO CHASSIS	NOTE 1
DLY 1 A01 21	GATE LINE	A05 31
DLY 2 A01 23	GATE 2	A15 34
BRI * A14 32	B'R *	A16 01
BRI A14 35	B'R	A16 02
B'R A04 36	GRD	A03 37

SIGNAL-PLUG-PIN:	SIGNAL-PLUG-PIN:	NOTES
B'R	A05 33 BRI	A04 32
BRI *	A04 35 B'R *	A05 36
BUFFER LO	A03 08 GRD	A02 12
BUFFER GD	A03 07 GRD	A02 12

REV	E.O.NO	DATE	APPD
A	PRR		
B	5074		

REDUCE THIS LINE
TO 1.00



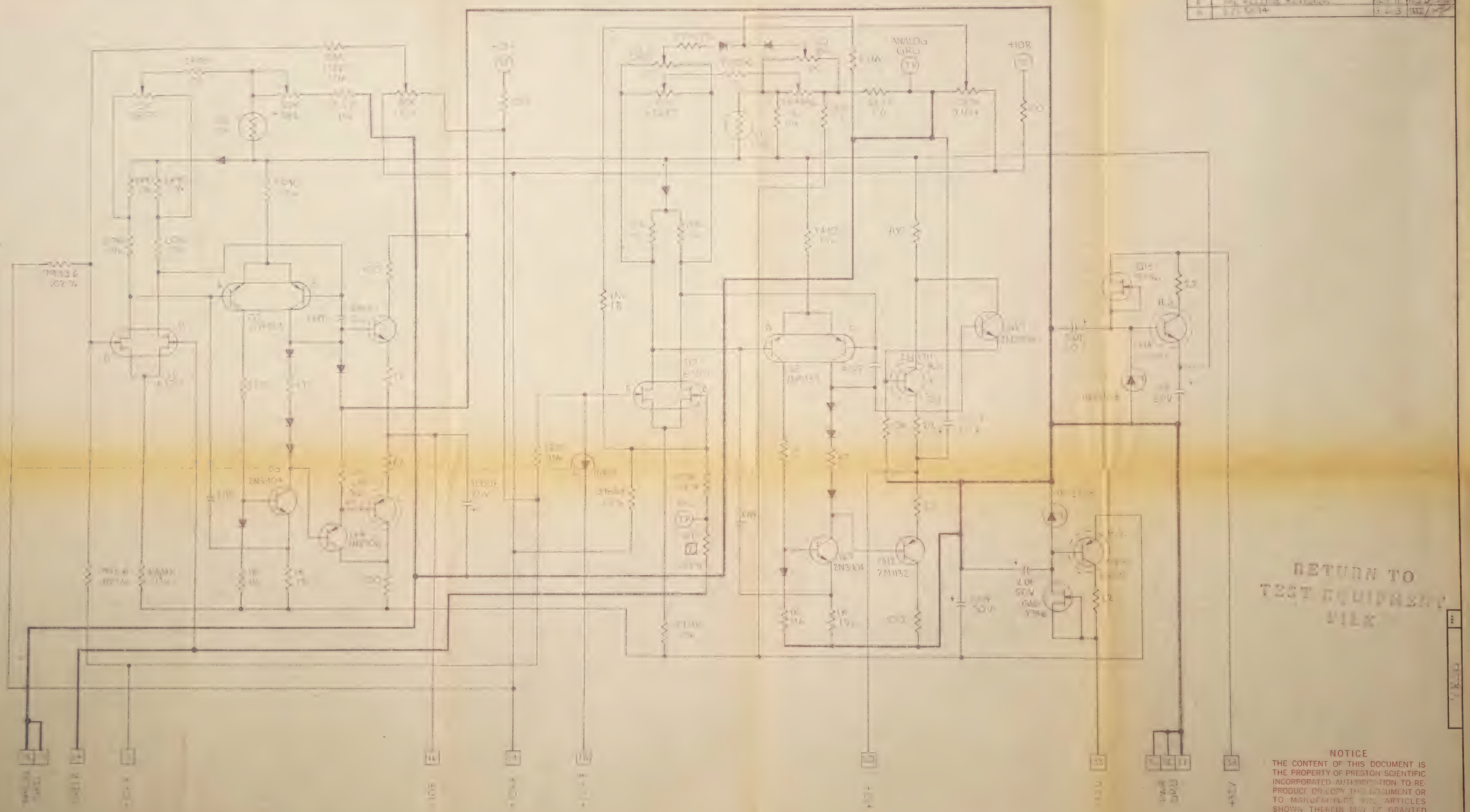
DRAWN	DATE 11 16 72	PRINTED CIRCUIT ASSY REFERENCE SUPPLIES	PRESTON SCIENTIFIC INC.
CHK		MATERIAL	FOR NOTES SEE SH 2.
APPD	11 28 72	FINISH	59655
ABBREVIATIONS PER MIL STD 12		SCALE 2/1	SIZE CODE SH 1 OF NEXT ASSY

MASTER • 56

NOTICE

THE CONTENT OF THIS DOCUMENT IS THE PROPERTY OF PRESTON SCIENTIFIC INCORPORATED. AUTHORIZATION TO REPRODUCE OR COPY THIS DOCUMENT OR TO MANUFACTURE THE ARTICLES SHOWN THEREIN MAY BE GRANTED ONLY BY SPECIFIC AUTHORIZATION IN WRITING AND SIGNED BY AN AUTHORIZED AGENT OF PRESTON SCIENTIFIC INCORPORATED.

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	[illegible]	2-1-72	[illegible]
B	[illegible]	3-6-73	[illegible]



RETURN TO TEST EQUIPMENT FILE

NOTICE
THE CONTENT OF THIS DOCUMENT IS THE PROPERTY OF PRESTON SCIENTIFIC INCORPORATED. AUTHORIZATION TO REPRODUCT OR COPY THIS DOCUMENT OR TO MANUFACTURE THE ARTICLES SHOWN THEREIN MAY BE GRANTED ONLY BY SPECIFIC AUTHORIZATION IN WRITING AND SIGNED BY AN AUTHORIZED AGENT OF PRESTON SCIENTIFIC INCORPORATED.

ITEM	REQD	PART NO.	DESCRIPTION	VALUE	REFERENCE DESIGNATION

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED

MECHANICAL DWG TOLERANCES
X ±.050 ANGULAR ±0° 30'
XX ±.020
XXX ±.005 MACH. SURF. 63
THREADS: CLASS 2A OR 2B
REMOVE BURRS & SHARP EDGES .020 MAX.
MACH. FILLET RADIUS .020 R MAX.
MACH. SURF. FLAT WITHIN .001 IN/IN
OTHER SURF. FLAT WITHIN .005 IN/IN

ELECTRICAL DWG DESIGNATIONS
REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATION WITH UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

	BY	DATE
DRAWN	[illegible]	11-16-72
CHK	[illegible]	3-12
ENGR		
APPD	[illegible]	11-9-72
APPD		

ABBREVIATIONS PER MIL-STD-32

TITLE: SCHEMATIC DIAGRAM REFERENCE DESIGNATIONS

PRESTON SCIENTIFIC INCORPORATED
Anaheim, Calif.

MATERIAL

FINISH

SCALE

D SIZE

596D6

CODE

SH 1 OF 1

NEXT ASSY

TITLE: P.C. ASSY REFERENCE SUPPLIES
DWG NO. 59655-00 REV C
SHEET 3 OF 4

PRESTON SCIENTIFIC INC.
PRINTED 3/07/73

PARTS LIST

ITEM	QTY	PART NO.	DESCRIPTION	
010	1	59658-00	D&R ASSY REF SUPPLIES	C
040	6	521-00	RESISTOR 1/4W 10% 22	
050	2	523-00	RESISTOR 1/4W 10% 47	
060	6	525-00	RESISTOR 1/4W 10% 100	
070	1	531-00	RESISTOR 1/4W 10% 1K	
090	1	536-00	RESISTOR 1/4W 10% 4700	
100	2	538-00	RESISTOR 1/4W 10% 10K	
101	1	555-01	RESISTOR 1/4W 10% 10M	
110	4	409-00	RESISTOR 1/4W 1% 1K	
111	1	421-00	RESISTOR 1/4W 1% 1870	
140	5	427-00	RESISTOR 1/4W 1% 2490	
141	1	456-03	RESISTOR 1/4W 1% 10K	
145	4	465-02	RESISTOR 1/4W 1% 20K	
146	1	469-00	RESISTOR 1/4W 1% 33.2K	
150	2	472-25	RESISTOR 1/4W 1% 49.9K	
160	1	475-02	RESISTOR 1/4W 1% 78.7K	
161	1	478-00	RESISTOR 1/4W 1% 100K	
162	1	479-00	RESISTOR 1/4W 1% 200K	
163	1	484-00	RESISTOR 1/4W 1% 499K	
164	1	488-16	RESISTOR 1/4W 1% 1M	
170	1	488-11	RESISTOR 1/2W 1% 2M	
180	1	998-20	RESISTOR .02% 1996	
190	1	998-25	RESISTOR .02% 3988.4	
200	2	998-46	RESISTOR .02% 7993.6	
220	1	374-02	THERMISTOR 5K	
221	1	374-05	THERMISTOR 10K	
230	3	351-80	POTENTIOMETER 5K	
240	3	369-02	POTENTIOMETER 50K	
250	2	372-03	POTENTIOMETER 50K	
270	4	58-01	CAPACITOR 10% 47PF	
280	2	116-00	CAPACITOR 2UF 50V	
290	2	142-01	CAPACITOR 10UF 50V	
300	2	147-01	CAPACITOR 20% 100UF 20V	
310	2	247-20	DIODE ZENER 1N5255B	
320	1	238-00	DIODE ZENER 1N825	
330	13	239-00	DIODE 1N4148	
340	3	824-00	TRANSISTOR 2N1132	
350	3	828-00	TRANSISTOR 2N1711	
360	3	846-00	TRANSISTOR 2N3904	
361	1	846-01	TRANSISTOR 2N3906	
370	2	846-08	TRANSISTOR 2N4939	
380	2	845-10	TRANSISTOR E7001	
390	2	9946-00	TRANSISTOR SELECT	A
391	4	284-01	HEAT SINK	

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

59655 - SELECTION OF R1

1. SET ALL POTENT[illegible]

2. INSTALL A [illegible]
RES TP AND ANALOG [illegible]

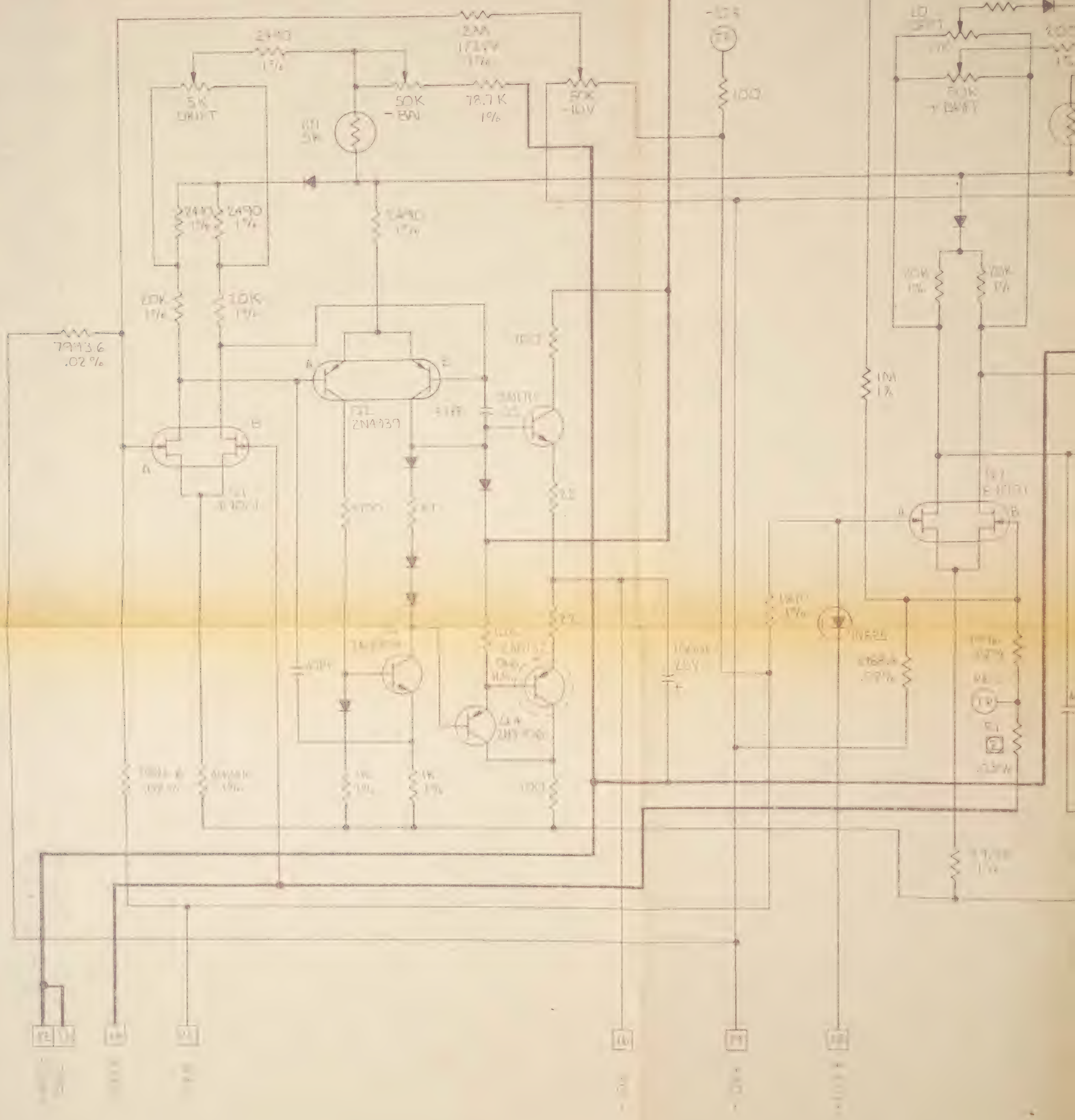
3. [illegible] VOLTAGE AT +10R TP, ADJUST [illegible]
SUBSTITUTION BOX [illegible] A [illegible] MA [illegible]
+10.000 VOLTS IS READ ON A DVM. [illegible]
BETWEEN 142 AND 787 OHMS

4. [illegible] +10V POTENTIO[illegible]
THAT THE VOLTAGE CAN BE ADJUSTED A [illegible] MA
EQUALLY EACH SIDE OF +10.000 VOLTS.

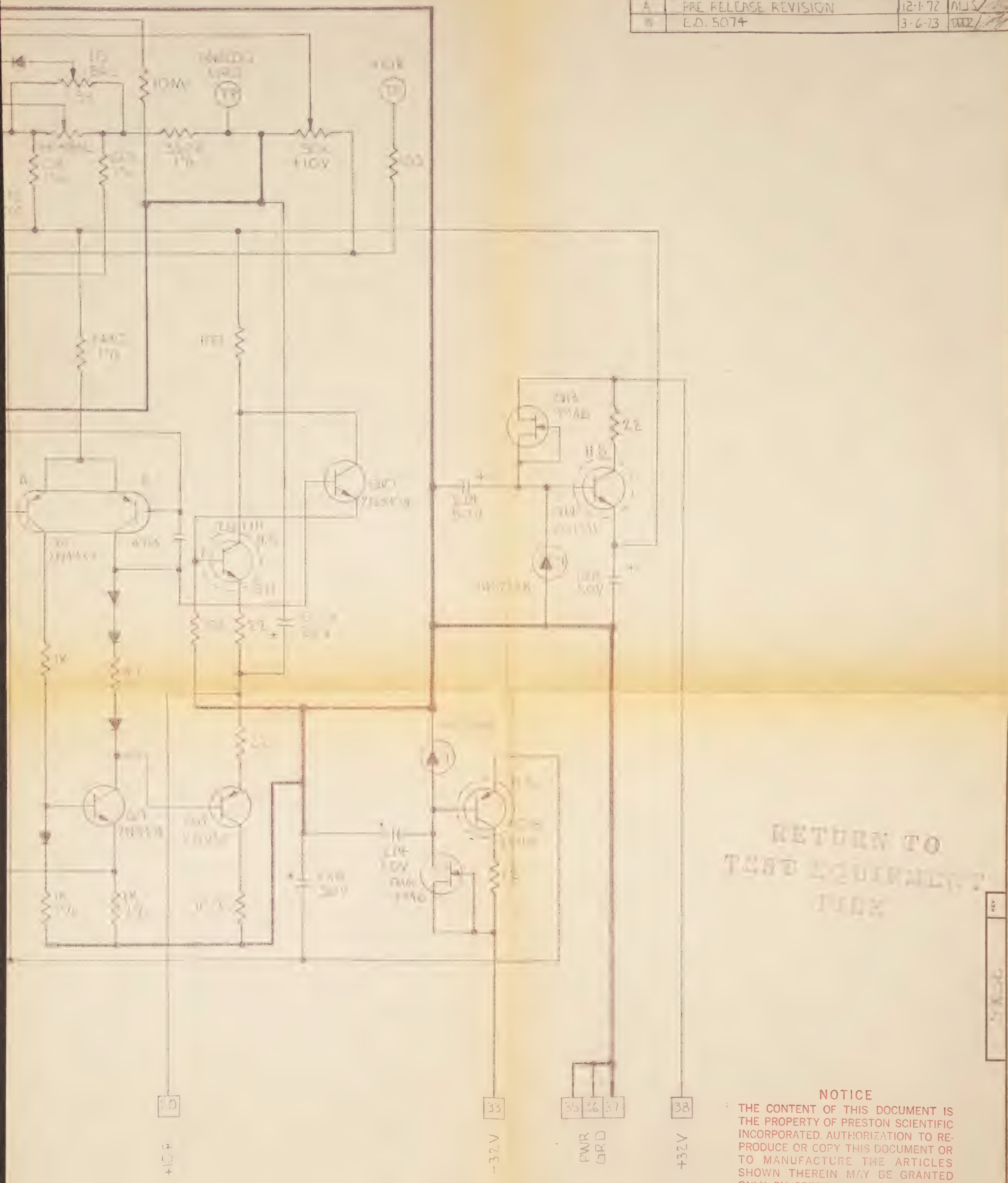
5. [illegible], READJUST THE RESISTOR SUBSTITUTION BOX [illegible]
[illegible] STEPS UNTIL THE [illegible] 4 AR[illegible]

6. [illegible] RESISTOR SUBSTITUTION B[illegible]. [illegible] A [illegible]
EQUIVALENT RESISTOR ± 2 OHMS ± .[illegible] ON THE 1
POSITION

BY	DATE	TITLE	PRESTON SCIENTIFIC INCORPORATED
DRAWN W.K.[illegible]	11/2/12	[illegible] R-1 SELECTION	
CHK [illegible]	11/2/12		
ENGR		MATERIAL	59655
APPD [illegible]	11-4-12		
APPD		FINISH	59655
NEXT ASSY		SCALE	SIZE A · CODE · SH 1 OF 1


2M
1% .5W
2.49K
1%
5K
SHUNT
50K
-BAL
78.7K
1%
5K
-10V
-15V
100
2.49K
1%
2.49K
1%
10K
1%
10K
1%
7993.6
.02%
2.49K
1%
100
2N4939
1M
1%
50K
+ BALT
10M
1%
20M
1%
INFRA

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	PRE RELEASE REVISION	12-1-72	MJS
B	E.D. 5074	3-6-73	



RETURN TO TEST EQUIPMENT INDEX

NOTICE
THE CONTENT OF THIS DOCUMENT IS THE PROPERTY OF PRESTON SCIENTIFIC INCORPORATED. AUTHORIZATION TO REPRODUCE OR COPY THIS DOCUMENT OR TO MANUFACTURE THE ARTICLES SHOWN THEREIN MAY BE GRANTED ONLY BY SPECIFIC AUTHORIZATION IN WRITING AND SIGNED BY AN AUTHORIZED AGENT OF PRESTON SCIENTIFIC INCORPORATED.

ITEM	MOD	PART NO.	DESCRIPTION	VALUE	REFERENCE DESIGNATION

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED

MECHANICAL DWG. TOLERANCES

X ± .050 ANGULAR ± 0° 30'
.XX ± .020 63
.XXX ± .005 MACH. SURF. ✓

THREADS: GLASS 2A OR 2B
REMOVE BURRS & SHARP EDGES .020 MAX.
MACH. FILLET RADIUS .020 R MAX.
MACH. SURF. FLAT WITHIN .001 IN/IN
OTHER SURF. FLAT WITHIN .005 IN/IN

ELECTRICAL DWG DESIGNATIONS

REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATION WITH UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH

	BY	DATE
DRAWN		
CHK		
ENGR		
APPD		
APPD		

ABBREVIATIONS PER MIL-STD-12

TITLE
SCHEMATIC DIAGRAM
REFERENCE SUPPLIES

PRESTON SCIENTIFIC INCORPORATED
Anaheim, Calif.

MATERIAL

FINISH

SIZE D

SCALE

CODE

SH 1 OF 1

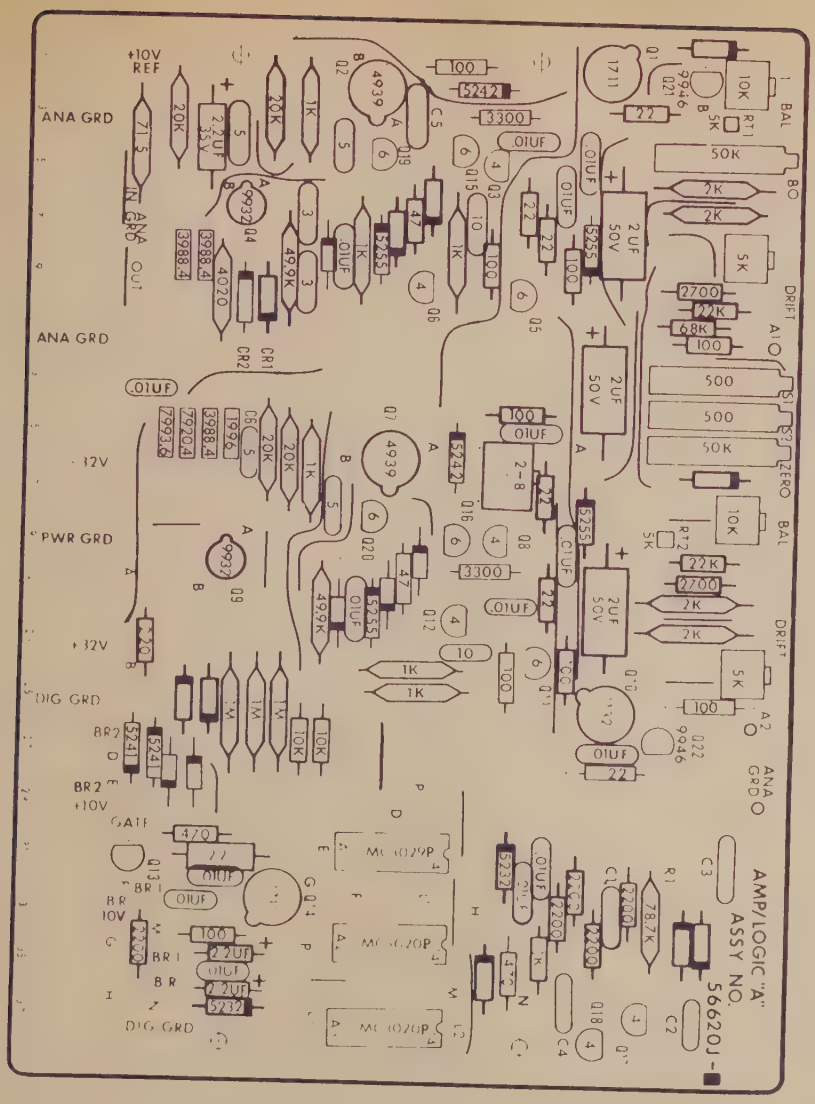
59655

TO MATCH REFERENCE.

NEXT ASSY

REDUCE THIS LINE TO 1.00

A	4196	11-29-71	
B	4202		
C	4266		
D	4283		
E	4374		
F	4405		
	4425		
	4441		
T	5093		



BY DRAWN MC CHK ENGR APPD APPD	DATE 11-10-71	TITLE PRINTED CIRCUIT ASSY AMP/LOGIC "A"	PRESTON SCIENTIFIC INSTRUMENTS INCORPORATED
		MATERIAL	FOR NOTES SEE SH 2
ABBREVIATIONS PER MIL-STD-12		FINISH	
	SCALE 2/1	SIZE B	CODE 56620-T
		SH 1 OF	NEXT ASSY 56600

MASTER • 56

NOTICE

THE CONTENT OF THIS DOCUMENT IS THE PROPERTY OF PRESTON SCIENTIFIC INCORPORATED. AUTHORIZATION TO REPRODUCE OR COPY THIS DOCUMENT OR TO MANUFACTURE THE ARTICLES SHOWN THEREIN MAY BE GRANTED ONLY BY SPECIFIC AUTHORIZATION IN WRITING AND SIGNED BY AN AUTHORIZED AGENT OF PRESTON SCIENTIFIC INCORPORATED.

1-02995

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1		

TABULATION				
DWG NO.	WIRE FROM	WIRE TO	C5 VALUE	C5 P/N
56620-00	L1	L3	2PF	47102
56620-01	L1	L2	2PF	47102
56620-02	L1	L3	OMIT	—

10. C6 & R1 NOMINAL VALUE [illegible]
9. Q13 IS: 2N5457
8. FOR LIST OF MATERIALS SEE SH 3 & 4 OF 4.
7. FOR WIRING L1, L2 & L3 SEE TABULATION.
6. WIRE FROM POINT TO POINT A TO A ETC.
5. C1 THRU C4 ARE TO BE SELECTED IN TEST.
4. ALL CAPACITOR VALUES ARE IN PF.
3. CR1 & CR2 ARE HP5082-2810.
2. ALL DIODES ARE IN4148.
1. FOR SCHEMATIC SEE DWG NO. 56621-T.

NOTE: UNLESS OTHERWISE SPECIFIED

BY	DATE
DRAWN	
CK	
IGR	
PD	
MD	

TITLE: PRINTED CIRCUIT ASSY AMP/LOGIC "A"

MATERIAL:

FINISH:

SCALE:

SIZE: A

PRESTON
SCIENTIFIC INCORPORATED
805 East Cerritos Ave., Anaheim, Calif. 92805
Tel. (714) 776-6400

56600 PC ASS'Y

56620-T

CODE:

SH 2 OF 4

TITLE: P.C. ASSY AMP/LOGIC A
DWG NO. 56620-00 REV J
SHEET 3 OF 4

PRESTON SCIENTIFIC INC.
PRINTED 1/24/72

PARTS LIST

ITEM	QTY	PART NO.	DESCRIPTION
010	1	56623-00	BAR ASSY AMP LOGIC A C
040	6	521-00	RESISTOR 1/4W 10% 22
050	2	523-00	RESISTOR 1/4W 10% 47
060	9	525-00	RESISTOR 1/4W 10% 100
070	1	527-00	RESISTOR 1/4W 10% 220
080	2	529-00	RESISTOR 1/4W 10% 470
090	1	531-00	RESISTOR 1/4W 10% 1K
100	5	533-00	RESISTOR 1/4W 10% 2200
110	2	534-00	RESISTOR 1/4W 10% 2700
115	2	535-00	RESISTOR 1/4W 10% 3300
120	2	538-00	RESISTOR 1/4W 10% 10K
130	2	541-00	RESISTOR 1/4W 10% 22K
134	1	546-00	RESISTOR 1/4W 10% 68K
140	1	594-18	RESISTOR 1/4W 1% 71.5
150	6	407-00	RESISTOR 1/4W 1% 1K
160	4	422-00	RESISTOR 1/4W 1% 2K
165	1	440-00	RESISTOR 1/4W 1% 4020
170	4	465-02	RESISTOR 1/4W 1% 20K
180	2	472-26	RESISTOR 1/4W 1% 49.9K
185	1	475-02	RESISTOR 1/4W 1% 70.7K
190	2	489-16	RESISTOR 1/4W 1% 1M
200	1	561-00	RESISTOR 1/2W 10% 22
210	1	998-24	RESISTOR .05% 1000
220	3	998-25	RESISTOR .05% 3738.4
230	1	998-45	RESISTOR .05% 7920.4
250	1	998-46	RESISTOR .05% 7953.6
260	2	344-07	POTENTIOMETER 500
265	2	351-80	POTENTIOMETER 5K
270	2	358-80	POTENTIOMETER 10K
280	2	372-03	POTENTIOMETER 50K
290	1	22-02	CAPACITOR 2PF
295	1	22-01	CAPACITOR TRIMMER 2-8PF
310	2	48-00	CAPACITOR 3PF
315	4	50-01	CAPACITOR 5PF
320	1	52-01	CAPACITOR 10% 10PF
360	15	93-01	CAPACITOR .01UF
370	3	116-00	CAPACITOR 2UF 50V
375	2	131-00	CAPACITOR 2.2UF 20V
380	1	133-00	CAPACITOR 2.2UF 35V
390	15	239-00	DIODE 1N4148
395	2	237-00	DIODE ZENER 1N5242B
400	2	248-13	DIODE ZENER 1N5241B
410	2	244-08	DIODE ZENER 1N5232B
420	4	247-20	DIODE ZENER 1N5255B
425	2	248-22	DIODE 5082-2810
430	1	824-00	TRANSISTOR 2N1132
440	2	828-00	TRANSISTOR 2N1711
460	6	846-00	TRANSISTOR 2N3904
470	6	846-01	TRANSISTOR 2N3906
480	2	846-08	TRANSISTOR 2N4939

TITLE P.C. ASSY AMP/LOGIC A
DWG NO. 5-620-00 REV J
SHEET 4 OF 4

PRESTON SCIENTIFIC CO. INC.
PRINTED 1/24/72

PARTS LIST

ITEM	QTY	PART NO.	DESCRIPTION
415	2	845-05	TRANSISTOR SELECTED 9952
425	2	9946-00	TRANSISTOR SELECT A
500	1	847-10	TRANSISTOR 2N5457
510	2	848-24	INTEGRATED CIRCUIT MC74-H-50P
520	1	848-26	INTEGRATED CIRCUIT MC3029P
525	2	374-02	THERMISTOR 5K

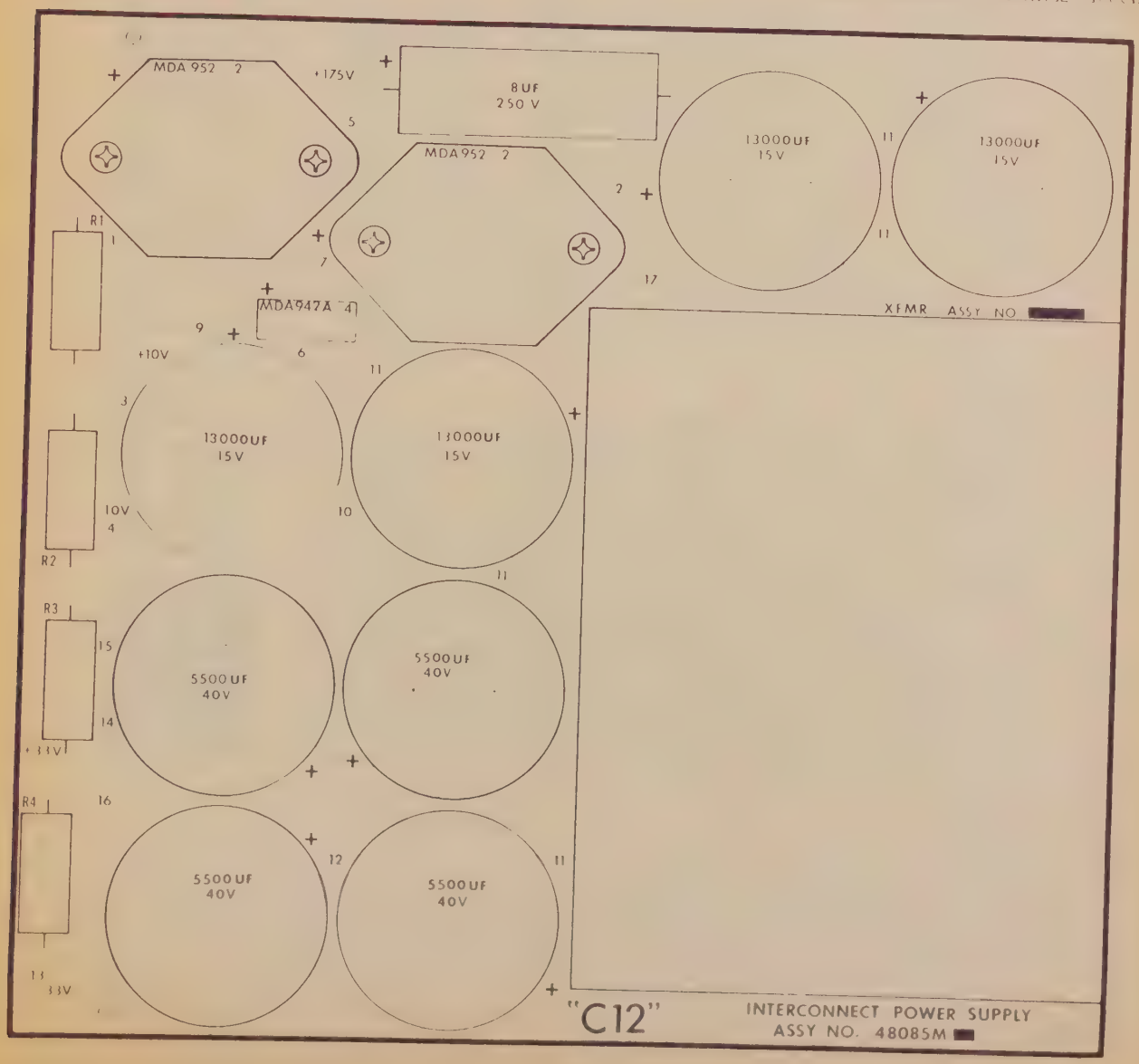
REVISIONS			
		DATE	APPROVAL
A	PRERELEASE REVISION	6-25-70	EM
B	PRE RELEASE REVISION	6-30-70	RR/
	E.O. 3787	8-17-70	RR/
D	E.O. 3798	8-21-70	AT/LL
E	E.O. 3906	2-18-71	PM/
	E.O. 4011	11-9-71	
	E.O. 4172	2-[illegible]-72	
H	E.O. 4264	[illegible]	
	[illegible]	3-8-73	
K	E.O. 5078	[illegible]	
L	E.O. 5083	8-23-73	
M	E.O. 5093	[illegible]	

48075			
NEXT ASSY			
DRAWN F Maya	DATE 6-11-70	TITLE PC ASSY INTERCONNECT POWER SUPPLY	PRESTON
TRACED R Pegnoo	6-16-70		
CHECKED JMM	7/1/70	MATERIAL	
APPD		FINISH	
ABBREVIATIONS PER MIL STD 12		SCALE 2/1	SIZE C
			48085-T

NOTICE
THE CONTENT OF THIS DOCUMENT IS THE PROPERTY OF PRESTON SCIENTIFIC INCORPORATED. ALL INFORMATION TO REPRODUCE OR COPY THIS DOCUMENT OR TO MANUFACTURE THE ARTICLES SHOWN THEREIN MAY BE GRANTED ONLY BY SPECIFIC AUTHORIZATION IN WRITING AND SIGNED BY AN AUTHORIZED AGENT OF PRESTON SCIENTIFIC INCORPORATED.

REDUCE THIS LINE TO 1.000 ± .010

6 MOUNT THERMOSTAT BRACKET ON RECTIFIER IN UPPER LEFT HAND CORNER OF BOARD
5 WHEN 2 RESISTOR VALUES APPEAR IN THE TABULATION BLOCK, MOUNT THEM IN PARALLEL.
4 ALL RESISTORS ARE 3W, 5%
3 FOR R1 THRU R4 VALUES SEE TABULATION, SH 3 OF 4
2 MARK XFMR ASSY NO PER TAB USING WHITE INK
1. FOR SCHEMATIC DIAGRAM POWER SUPPLY SEE TABULATION, SH 3 OF 3.
NOTES UNLESS OTHERWISE SPECIFIED



TITLE: P.C. ASSY POWER SUPPLY
DWG NO. 48085-00 REV -1-
SHEET 1 OF 1

PRESTON SCIENTIFIC INC.
PRINTED 6/16/75

PARTS LIST

ITEM	QTY	PART NO.	DESCRIPTION	
010	1	48088-00	D&R ASSY INTERCONN PWR SUP	C
020	1	46027-00	TRANSFORMER ASSY	C
022	1	48229-00	THERMOSTAT BRACKET	4
030	4	608-07	RESISTOR 3W 5%	2
040	1	136-00	CAPACITOR	8UF 250V
050	4	157-17	CAPACITOR	13000UF 15V
060	4	157-23	CAPACITOR	5500UF 40V
070	1	245-02	RECTIFIER BRIDGE	MDA942A-4
080	2	246-01	RECTIFIER BRIDGE	MDA952-2
090	1	800-02	THERMOSTAT	
100	1	843-02	WASHER E.T. #8	
110	4	871-00	WASHER FLAT #8	
120	3	876-00	WASHER LOCK #8	
125	2	628-00	SCREW FHMS 4-40 X 3/16	
130	4	672-00	SCREW PHMS 4-40 X 3	
140	8	855-00	WASHER FLAT #4 SM	
145	16	864-00	WASHER E.T. # 10	
150	4	874-00	WASHER LOCK #4	
160	6	318-00	NUT 4-40	
170	4	313-00	NUT 8-32	
180	16	724-00	SCREW HEX HD 10-32 X 3/8	

REVISIONS

TABULATION

PART NO	XFMR NO	SCHEMATIC	R1 VALUE	R2 VALUE	R3 VALUE	R4 VALUE
48085-00	46027-00	48086-00	2	2		
-01	56064-00	48086-01	2	2		
-02	56060-00	56056-00	2	2	2	
-03	56136-00	56102-00	2	2		
-04	52204-00	48086-02	2	.5		2
-05	52204-00	48086-03	.5	.25		
-06	46027-00	48086-04	1	2	2	2
-07	46027-00	48086-05	3, 5W	2	.2, 2W	.2, 5W
-08	46027-00	48086-06	.3, 5W	.5, 5W	1	1
-09	46027-00	48086-07	.5 / .5	2	.2	.2
-10	46027-00	48086-08	1	1	2	
-11	46027-00	48086-09	1	1	1	1
-12	46027-00	48086-10	.5	1	1	1
-13	46027-00	48086-11	.5	2	2	
-14	56136-00	56056-01	2	2	1, 3.4W	
-15	56100-00	56056-02	1	2	2	2
-16	46027-00	56056-03	.5, 5W	2	2	2
-17	56060-00	56056-04	1	1	1	1
-18	46027-00	56259-00	1	2	2	2
-19	46027-00	56259-01	.5	2	2	2
-20	46027-00	59744-00	.5, 5W	2	2	2
48085-21	56536-00	56591-00	.3, 5W / .3, 5W	2	.5, 1W / .5, 1W	.5, 1W / .5, 1W

BY	DATE
DRAWN	2-15-73
CHK	2-21-73
ENGR	2-21-73
APPD	
APPD	

TITLE PRINTED CIRCUIT ASSY
INTERCONNECT POWER SUPPLY

MATERIAL

FINISH

SCALE

A
SIZE

PRESTON SCIENTIFIC INCORPORATED

48085-T

CODE

SH 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

TABULATION

PART NO.	VENDOR NO.	SCHEMATIC	R1 VALUE	R2 VALUE	R3 VALUE	R4 VALUE
48085-22	46027-00	48086-12	.5Ω, 5W	.5Ω, 5W	.5Ω, 5W	.5Ω, 5W
48085-23	46027-00	48086-13	1Ω, 5W	1Ω	1Ω, 5W	1Ω
48085-24	46027-00	58015	.5Ω, 5W	2Ω	1Ω	1Ω
48085-25	46027-00	48086-14	.5Ω, 5W	2Ω	1Ω	1Ω

BY	DATE
DRAWN M. J. STEM	2-15-73
CHK	2-21-73
ENGR C. Hall	2-21-73
APPD	
APPD	

TITLE: PRINTED CIRCUIT ASSY INTERCONNECT PWR SUPPLY

MATERIAL

FINISH

SCALE

SIZE: A

PRESTON SCIENTIFIC INCORPORATED

48085-T

CODE

SH 4 OF 4

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

TABULATION

DASH NO.	XFMR NO	R1 VALUE	R2 VALUE	R3 VALUE	R4 VALUE
48086-00	46027	3 Ω	2 Ω	1 Ω	2 Ω
48086-01	52204	2 Ω	3 Ω	1 Ω	2 Ω
48086-02	52204	2 Ω	3 Ω	1 Ω	2 Ω
48086-03	52204	.5 Ω	.5 Ω	1 Ω	1 Ω
48086-04	46027	1 Ω	2 Ω	1 Ω	1 Ω
48086-05	46027	.3 Ω, 5W	1 Ω	.3 Ω, 5W	.3 Ω, 5W
48086-06	46027	.3 Ω, 5W	.5 Ω, 5W	.5 Ω	1 Ω
48086-07	46027	.5 Ω	.5 Ω	.5 Ω	.5 Ω
48086-08	46027	1 Ω	1 Ω	1 Ω	1 Ω
48086-09	46027	1 Ω	1 Ω	1 Ω	1 Ω
48086-10	46027	.5 Ω	1 Ω	1 Ω	1 Ω
48086-11	46027	.5 Ω	1 Ω	1 Ω	1 Ω
48086-12	46027	.5 Ω, 5W	.5 Ω, 5W	.5 Ω, 5W	.5 Ω, 5W
48086-13	46027	1 Ω, 5W	1 Ω	1 Ω, 5W	1 Ω
48086-14	46027	.5 Ω, 5W	2 Ω	1 Ω	1 Ω

BY	DATE
DRAWN	
CHK	2-21-73
ENGR	
APPD	
APPD	

TITLE: SCHEMATIC DIAGRAM INTERCONNECT PWR. SUPPLY

MATERIAL

FINISH

SCALE

SIZE: A

PRESTON SCIENTIFIC INCORPORATED

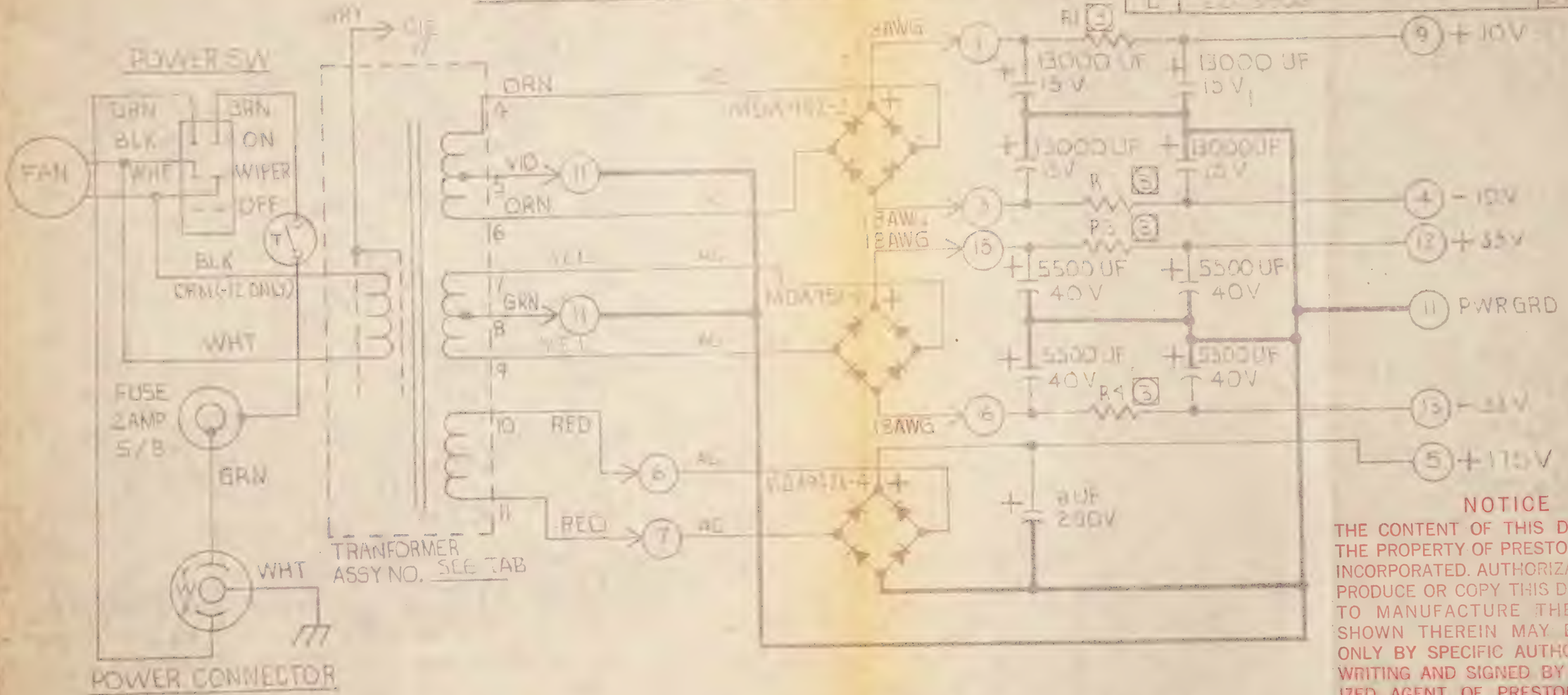
48086-T

CODE

SH 2 OF 2

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	PER ECR 5278	6-22-70	T.M./C.E.
B	PER ECR 5278	8-21-70	A.T./E.R.
C	PER ECR 5906	2-18-71	T.M./ J.E.P.

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
D	PER ECR 5278	11-4-70	C.P./C.
E	PER ECR 5278	2-10-71	W.T./E.T.
F	PER ECR 5278	2-15-72	[illegible]
G	PER ECR 5078	3-7-72	[illegible]



NOTICE

THE CONTENT OF THIS DOCUMENT IS THE PROPERTY OF PRESTON SCIENTIFIC INCORPORATED. AUTHORIZATION TO REPRODUCE OR COPY THIS DOCUMENT OR TO MANUFACTURE THE ARTICLES SHOWN THEREIN MAY BE GRANTED ONLY BY SPECIFIC AUTHORIZATION IN WRITING AND SIGNED BY AN AUTHORIZED AGENT OF PRESTON SCIENTIFIC INCORPORATED.

NOTES: 1. UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE 3W 5%
2. ALL WIRES ARE 22 AWG.
3. FOR R1 THRU R4 VALUES SEE TABULATION SH. 2 OF 2.
4. FOR TRANSFORMER NO. SEE TABULATION SH. 2 OF 2.

BY	DATE
DRAWN E. MAYER	6-4-70
CHK K. REYNOSO	6-15-70
[illegible]	7-22-70
APPD	

12756-T

NEXT ASSY

TITLE: SCHEMATIC DIAGRAM INTERCONNECT PWR SUPPLY

MATERIAL

FINISH

SIZE

PRESTON
SCIENTIFIC INCORPORATED

480R6-T

SH 1 OF 2

MASTER NO. 80

PART NO
56606D
"A"

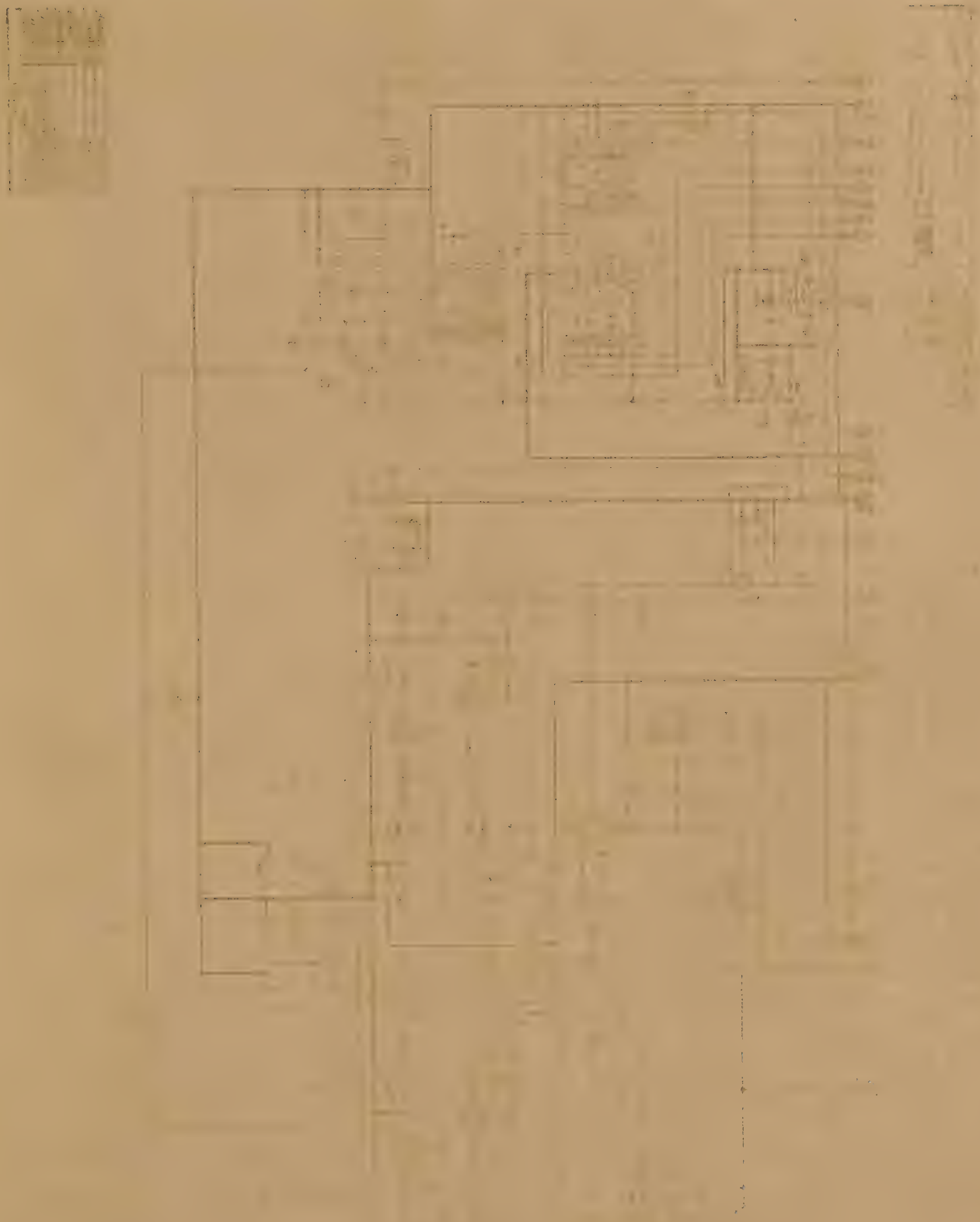
PRINTED CIRCUIT MASTER
INTERCONNECT BOARD "A"

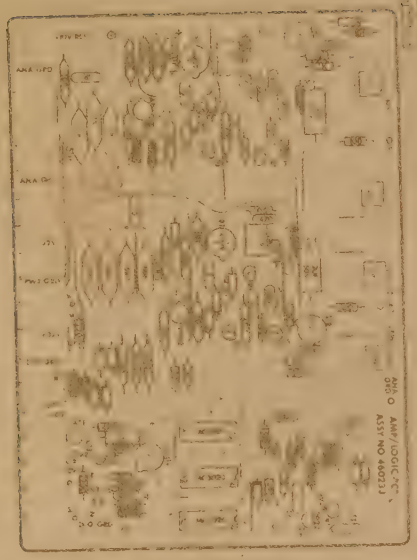
56606

D

NOTICE

THE CONTENT OF THIS DOCUMENT IS THE PROPERTY OF PRESTON SCIENTIFIC INCORPORATED. AUTHORIZATION TO REPRODUCE OR COPY THIS DOCUMENT OR TO MANUFACTURE THE ARTICLES SHOWN THEREIN MAY BE GRANTED ONLY BY SPECIFIC AUTHORIZATION IN WRITING AND SIGNED BY AN AUTHORIZED AGENT OF PRESTON SCIENTIFIC INCORPORATED.





PRINTED CIRCUIT ASSY
AMP/LOGIC "C"

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1 OF 5		

9. (※) RESISTORS MUST BE NC-6 TYPE.
8. VALUES FOR R1 & C1-C4 ARE SELECTED IN TEST.
7. FOR LIST OF MATERIAL SEE SHEET 4 & 5 OF 5.
6. FOR WIRING L1, L2 & L3 SEE TAB SHEET 3 OF 5.
5. Q13 TRANSISTOR IS 2N5457.
4. ALL CAPACITOR VALUES ARE IN PF.
3. WIRE FROM POINT TO POINT "A" TO "A", ETC.
2. ALL DIODES ARE 1N4148.
1. FOR SCHEMATIC SEE DWG. 46024.

NOTE: UNLESS OTHERWISE SPECIFIED

	11-21-73	PRINTED CIRCUIT ASSY AMP/LOGIC "C"	
ANALOG			A 46023-T
NEXT ASSY			

SEE SHEET 1 OF 5

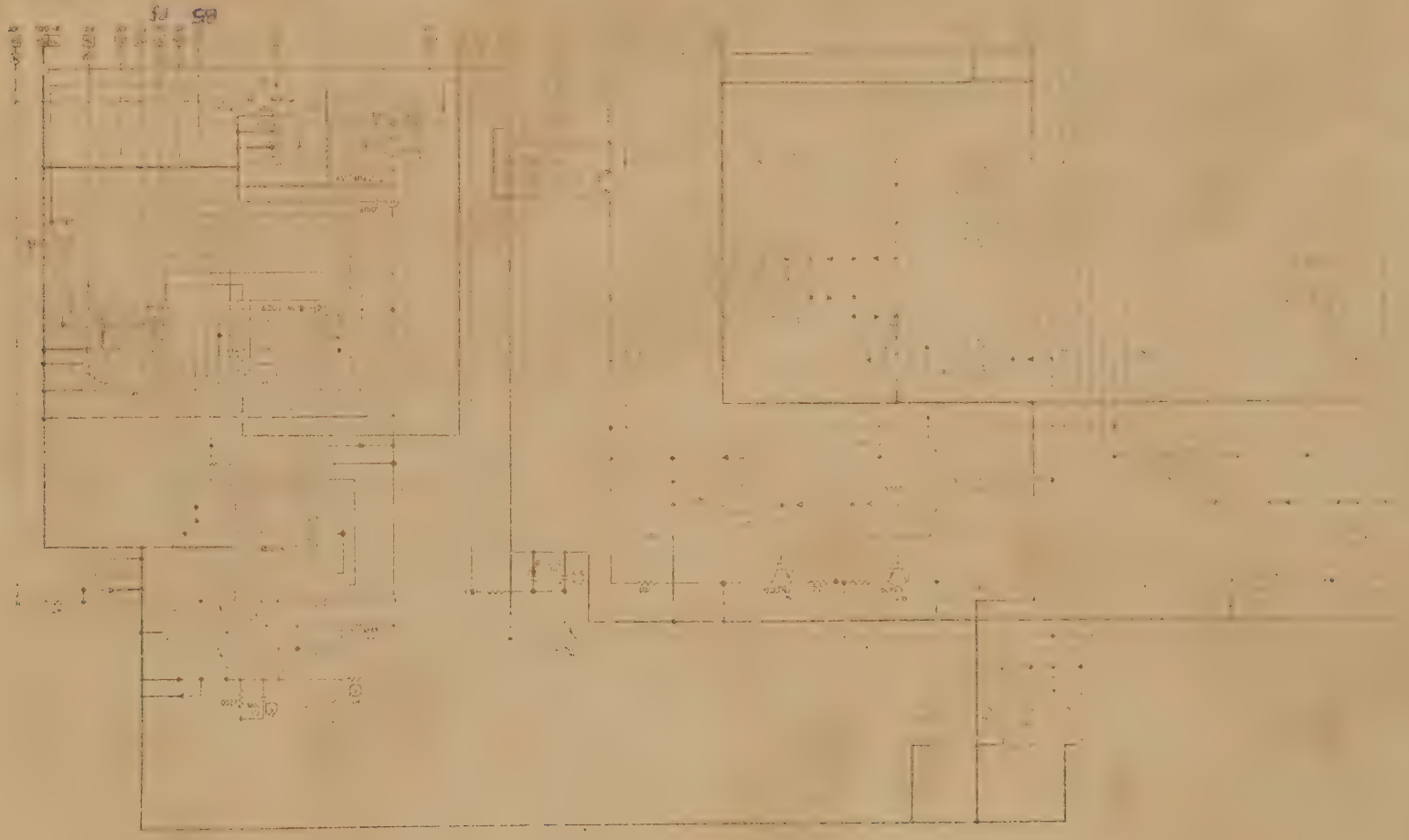
TABULATION

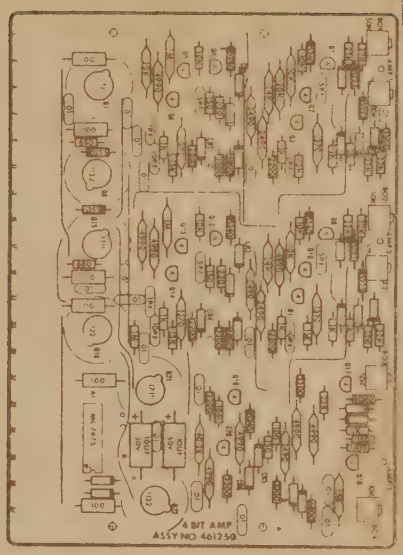
	WIRE

			A 46023-T
NEXT ASSY			

PRESTON SCIENTIFIC INC. BILL OF MATERIALS REPRINTED 4/14/73
ASSY 46023-00 REV. J SHEET 3 OF 5

ITEM	QTY	PART NO.	DESCRIPTION
10	1	46026-00-00	DRILL & RIVET
40	6	521-00-03	RESISTOR 1/4W 10% 22
50	2	523-00-04	RESISTOR 1/4W 10% 47
60	10	525-00-05	RESISTOR 1/4W 10% 100
70	1	527-00-06	RESISTOR 1/4W 10% 220
80	2	529-00-07	RESISTOR 1/4W 10% 470
90	3	531-00-08	RESISTOR 1/4W 10% 1K
100	5	533-00-09	RESISTOR 1/4W 10% 2200
120	2	538-00-06	RESISTOR 1/4W 10% 10K
140	1	397-13-09	RESISTOR 1/4W 1% 100
150	4	401-04-18	RESISTOR 1/4W 1% 402
160	2	405-00-02	RESISTOR 1/4W 1% 590
180	4	440-00-03	RESISTOR 1/4W 1% 806
200	2	456-03-02	RESISTOR 1/4W 1% 10K
210	1	471-03-04	RESISTOR 1/4W 1% 20.5K
220	1	468-01-03	RESISTOR 1/4W 1% 25.5K
230	1	478-05-07	RESISTOR 1/4W 1% 15K
250	1	561-00-01	RESISTOR 1/2W 10% 22
252	1	494-05-04	RESISTOR 1/2W 1% 806
253	3	495-00-03	RESISTOR 1/2W 1% 1K
254	1	495-06-07	RESISTOR 1/2W 1% 1580
256	1	496-02-03	RESISTOR 1/2W 1% 3160
258	1	496-05-05	RESISTOR 1/2W 1% 3240
260	1	344-80-02	POTENTIOMETER 500
270	2	346-80-03	POTENTIOMETER 2K
280	1	369-02-02	POTENTIOMETER 50K
290	2	79-01-09	CAPAC 2-6PF
300	1	47-02-01	CAPAC 20PF
320	4	50-01-03	CAP 50PF
340	5	52-01-01	CAPACITOR 100PF
345	1	51-01-30	CAPACITOR 470PF
350	4	72-01-00	CAPACITOR .001
360	9	9[illegible]	CAPACITOR .01
370	2	116 [illegible]	CAPACITOR .05
380	2	11 [illegible]	CAPACITOR 1.0
385	1	[illegible]	CAPACITOR 2.2
390	15	[illegible]	[illegible]
400	2	[illegible]	[illegible]
410	2	[illegible]	[illegible]
420	2	[illegible]	[illegible]
430	2	[illegible]	[illegible]
440	1	[illegible]	[illegible]
450	2	[illegible]	[illegible]
460	[illegible]	[illegible]	[illegible]
470	[illegible]	[illegible]	[illegible]
480	2	[illegible]	[illegible]
490	2	[illegible]	[illegible]
500	2	[illegible]	[illegible]





REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SH 1.		

7. INSTALL HEAT SINK (ITEM 390) ON TRANSISTORS Q7,8,15,16,21&22 USING SILICONE GREASE (ITEM 410).

6. CAPACITANCE IN UF.
5. CR1-CR6 ARE HP 5082-2810.
4. WIRE POINT TO POINT A TO A, B TO B ETC.
3. FOR SCHEMATIC DIAGRAM SEE DWG 46126.
2. ALL DIODES ARE 1N4148.
1. ALL RESISTORS ARE 1/4W, 10%.

NOTE: UNLESS OTHERWISE SPECIFIED

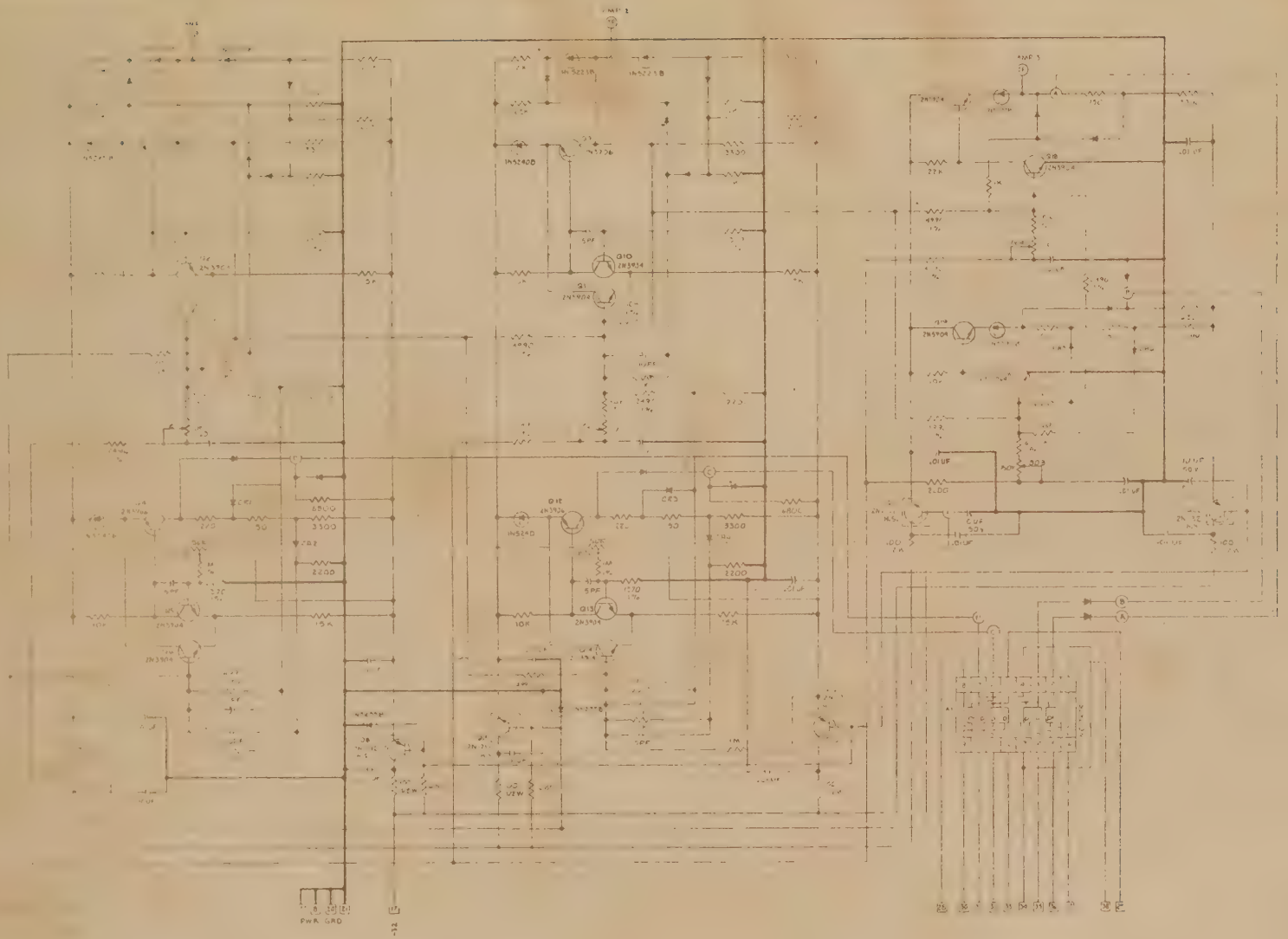
DRAWN		TITLE: PRINTED CIRCUIT ASSY 4 BIT AMP	PRESTON SCIENTIFIC
CHK			
APVD			
		SIZE: A	

TITLE: P.C. ASSY 4 BIT AMP
DWG NO. 46125-00 REV G
SHEET 2 OF 3

PRESTON SCIENTIFIC INC.
PRINTED 3/21/78

PARTS LIST

ITEM	QTY	PART NO.	DESCRIPTION
010	1	46128-00	DRILL & RIVET ASSY
040	1	525-00	RESISTOR 1/4W 10% 100
050	4	525-03	RESISTOR 1/4W 10% 150
060	2	527-00	RESISTOR 1/4W 10% 220
070	2	530-00	RESISTOR 1/4W 10% 680
080	9	531-00	RESISTOR 1/4W 10% 1000
090	6	533-00	RESISTOR 1/4W 10% 2200
100	6	535-00	RESISTOR 1/4W 10% 3300
110	3	537-00	RESISTOR 1/4W 10% 6800
120	5	538-00	RESISTOR 1/4W 10% 10K
130	4	540-00	RESISTOR 1/4W 10% 15K
140	9	541-00	RESISTOR 1/4W 10% 22K
150	1	551-00	RESISTOR 1/4W 10% 1M
160	6	565-00	RESISTOR 1/2W 10% 100
170	4	414-00	RESISTOR 1/4W 1% 1370
180	5	427-00	RESISTOR 1/4W 1% 2490
190	8	445-00	RESISTOR 1/4W 1% 4990
200	2	456-03	RESISTOR 1/4W 1% 10K
205	1	460-00	RESISTOR 1/4W 1% 15K
210	2	465-02	RESISTOR 1/4W 1% 20K
220	1	471-03	RESISTOR 1/4W 1% 40.2K
230	2	469-01	RESISTOR 1/4W 1% 34K
232	2	488-16	RESISTOR 1/4W 1% 1M
234	3	358-80	POTENTIOMETER 10K
236	3	369-02	POTENTIOMETER 50K
240	4	244-03	DIODE ZENER 1N5230
250	6	248-10	DIODE ZENER 1N5240B
260	2	247-20	DIODE ZENER 1N5255B
270	18	239-00	DIODE 1N4148
275	6	248-22	DIODE HP 5082-2810
280	2	47-01	CAPACITOR 1PF
290	1	48-00	CAPACITOR 3PF
300	4	50-01	CAPACITOR 5PF
310	3	52-01	CAPACITOR 10PF
320	16	93-01	CAPACITOR .01UF
330	2	142-01	CAPACITOR 10UF, 50V
340	3	828-00	TRANSISTOR 2N1711
350	3	824-00	TRANSISTOR 2N1132
360	12	846-00	TRANSISTOR 2N3904
370	4	844-01	TRANSISTOR 2N3906
380	1	848-27	INTEGRATED CIRCUIT MC7475
390	6	284-01	HEAT SINK
410	A/R	904-01	SILICONE GREASE

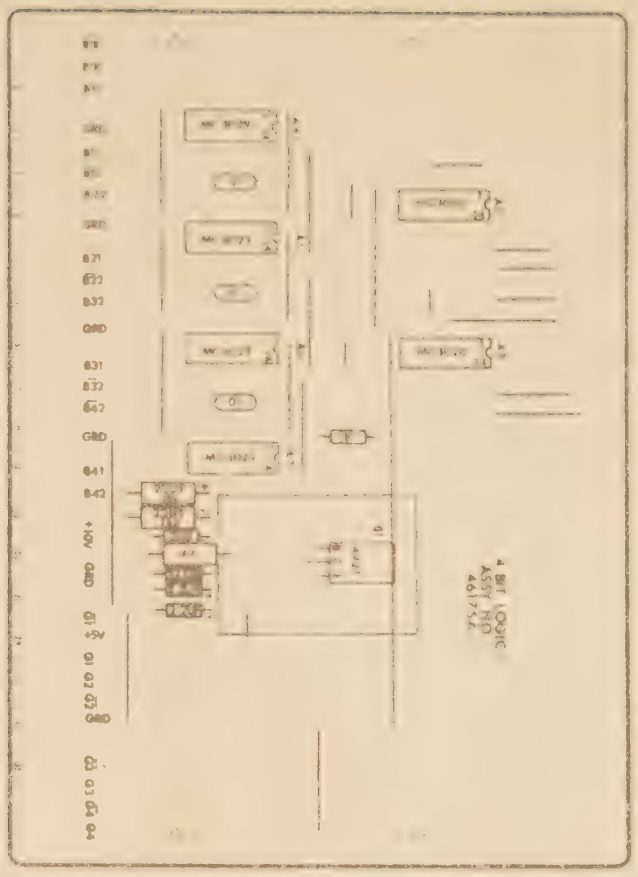


2. CR1 THRU CR6 ARE HP 5082-2810.
1. ALL RESISTORS ARE 1/4W 10%.
NOTE: UNLESS OTHERWISE SPECIFIED.

SCHEMATIC DIAGRAM
4 BIT AMP

46126
NEXT ASSY

R 46126



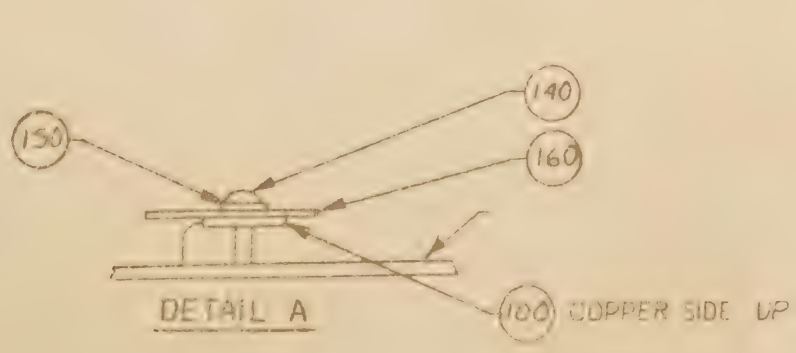
PRINTED CIRCUIT ASSY
4 BIT LOGIC

FOR NOTES SEE SH 3.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1 OF 1 FOR REVISIONS		

PRESTON SCIENTIFIC INC. BILL OF MATERIALS REPRINTED 3/31/71
ASSY 46175-00 REV. A SHEET 3 OF 3

ITEM	QTY	PART NO.	DESCRIPTION
10	1	46178-00-08	DRILL & RIVET ASSY
40	1	00527-00-06	RESISTOR, 1/4W, 10% 220
50	1	00531-00-08	RESISTOR, 1/4W, 10% 1000
60	1	00560-00-06	RESISTOR, 1/2W, 10% 47
70	1	00244-08-06	DIODE, ZENER IN5232
80	3	00093-01-05	CAPACITOR, .01UF
90	2	00131-00-03	CAPACITOR, 2.2UF
95	2	144-00-04	CAPACITOR 22UF 15V
100	1	00846-03-02	TRANSISTOR, 2N4921
110	2	00848-24-03	INTEGRATED CIRCUIT MC3020
120	4	00848-26-08	INTEGRATED CIRCUIT MC3029
140	1	00665-00-07	SCREW PHMS 4-40 X 5/16
150	1	00859-02-06	WASHER, SHOULDER
160	1	46079-00-18	HEAT SINK



DETAIL A

3. FOR HEATSINK ASSY SEE DETAIL A
2. FOR SCHEMATIC DIAGRAM SEE DWG 46176.
1. ALL RESISTORS ARE 1/4W, 10%.

NOTE : UNLESS OTHERWISE SPECIFIED

BY	DATE
DRAWN D.L. STARKS	3-12-71
CHK D.L. STARKS	4/6/71
ENGR D.L. STARKS	4/6/71
APPD	
MFG	

TITLE: PRINTED CIRCUIT ASSY 4 BIT LOGIC

PRESTON SCIENTIFIC INCORPORATED

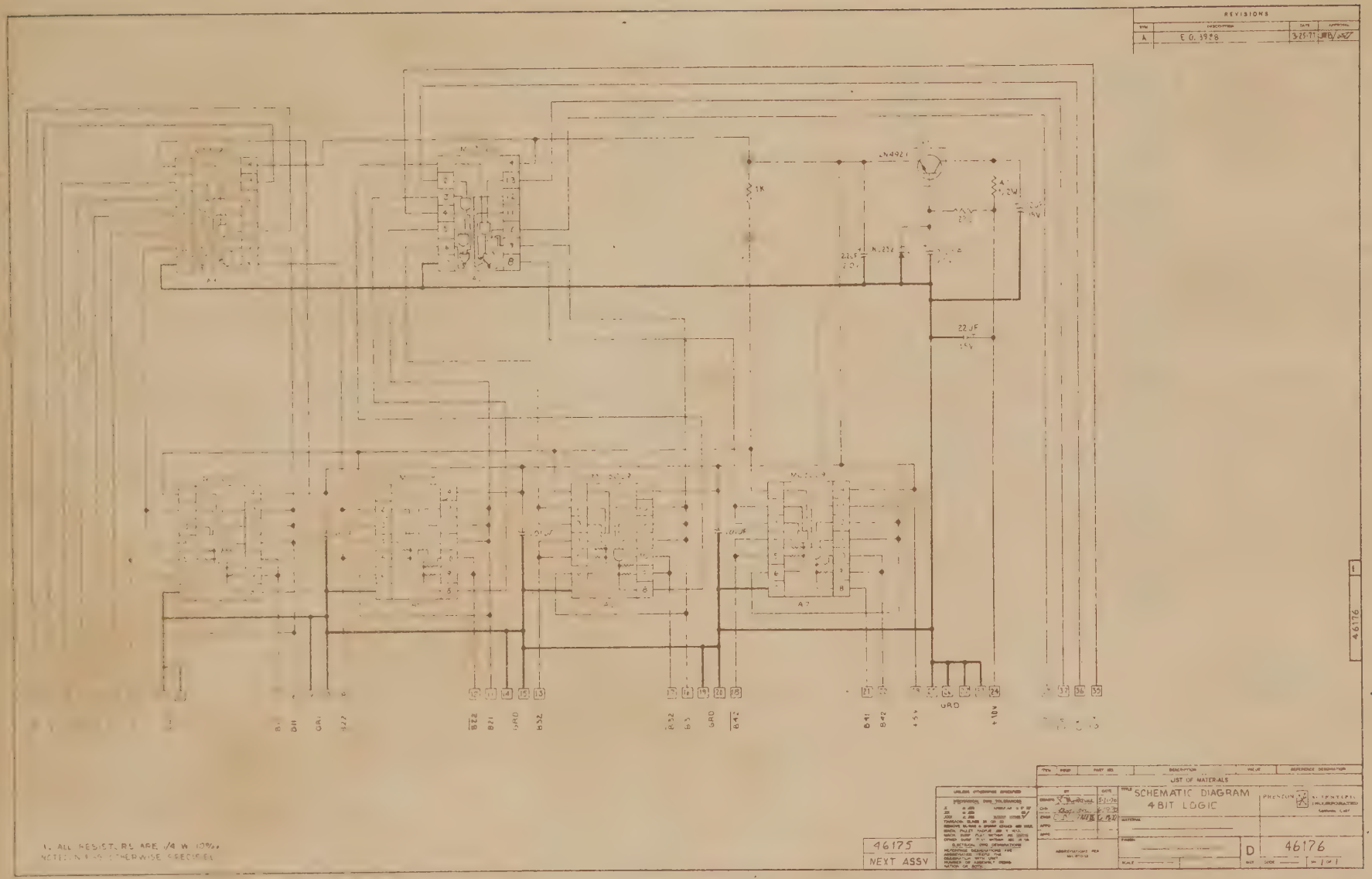
MATERIAL

FINISH

SCALE

46175

SIZE B — 2 OF 3



1. ALL RESISTORS ARE 1/4 W ±10%
NOTE: UNLESS OTHERWISE SPECIFIED

ITEM	QTY	PART NO.	DESCRIPTION	VALUE	REFERENCE DESIGNATION

LIST OF MATERIALS

DRAWN		DATE	5-1-70
CHK			
ENGR			
APPD			
MFG			

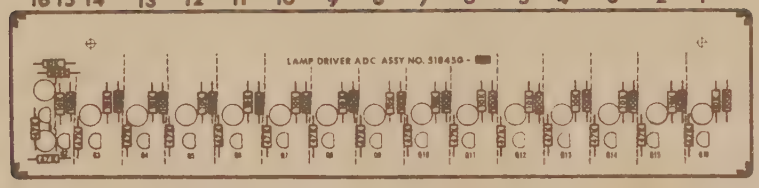
TITLE: SCHEMATIC DIAGRAM
4 BIT LOGIC

MATERIAL:

FINISH:

46175	D	46176
NEXT ASSY	SIZE	SHT 1 OF 1

5-72



4. FOR BILL OF MATERIALS SEE SH 3 OF 3.
3. FOR TABULATION SEE SH 2 OF 3.
2. ALL TRANSISTORS ARE 2N4410.
1. FOR SCHEMATIC DIAGRAM SEE DWG NO. 51846.
NOTE: UNLESS OTHERWISE SPECIFIED.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		1 SEE SH 1		

TABULATION	
DASH NO.	OMIT CIRCUIT
51845	———
51845 - 1	16
- 2	16-15
- 3	16-14
- 4	16-13
- 5	16-12
- 6	16-11
- 7	16-10
- 8	16-9
- 9	16-8
- 10	16-7
- 11	16-6
- 12	16-5
- 13	16-4
- 14	14
- 15	14-13
- 16	14-12
51845 - 17	14-11

TABULATION	
DASH NO.	OMIT CIRCUIT
51845 - 18	14-10
- 19	14-9
- 20	14-8
- 21	14-7
- 22	14-6
- 23	1-6 & 15
- 24	1-6 & 14
51845 - 25	1-6

	BY	DATE
DRAWN	R. REYNOLDS	8-3-72
CHK	J. STEWART	8-3-72
ENGR	D. C. MORRIS	8-4-72
APPD		
APPD		

TITLE: PRINTED CIRCUIT ASSY LAMP DRIVER

MATERIAL:

FINISH:

SCALE:

SIZE: A

CODE:

51825

NEXT ASSY

51845-T

SH 2 OF 3

PRESTON
SCIENTIFIC INCORPORATED
603 East Cerritos Ave. Anaheim, Calif. 92805
Tel (714) 776-6400

PRESTON SCIENTIFIC INC. BILL OF MATERIALS REPRINTED 10/22/70
ASSY 51845-00 REV.... SHEET 3 OF 3

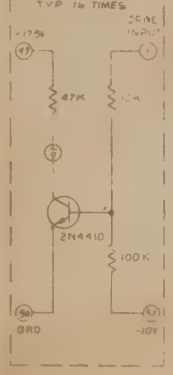
ITEM	QTY	PART NO.	DESCRIPTION	
10	1	51848-00-06	DRILL & RIVET ASSY	
20	16	538-00-06	RESISTOR 1/4W 10%	10K
30	16	544-00-09	RESISTOR 1/4W 10%	47K
40	16	547-00-05	RESISTOR 1/4W 10%	100K
50	16	846-06-04	TRANSISTOR	2N4410
60	16	288-02-02	LAMP NEON	

DASH NO.	AS SHOWN
-1	OMIT CIRCUIT 16
-2	16-15
-3	16-14
-4	16-13
-5	16-12
-6	16-11
-7	16-10
-8	16-9
-9	16-8
-10	16-7
-11	16-6
-12	16-5
-13	16-4
-14	16-3
-15	16-2
-16	16-1
-17	16-0
-18	15-15
-19	15-14
-20	15-13
-21	15-12
-22	OMIT CIRCUIT 15-0

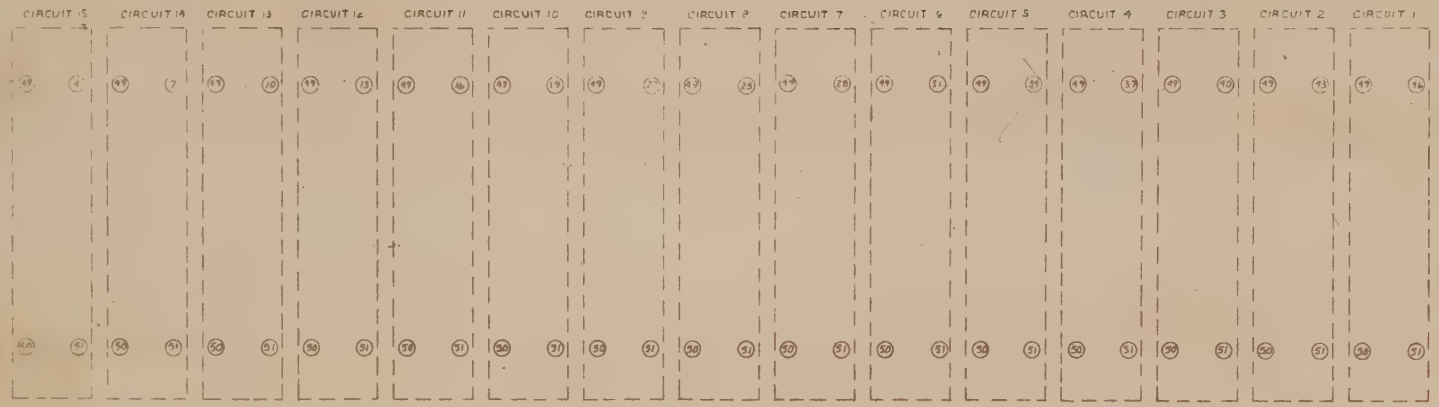
REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
A	E.C. 1...		

CIRCUIT 16 — TYP 16 TIMES



CIRCUIT 15 | CIRCUIT 14 | CIRCUIT 13 | CIRCUIT 12 | CIRCUIT 11 | CIRCUIT 10 | CIRCUIT 9 | CIRCUIT 8 | CIRCUIT 7 | CIRCUIT 6 | CIRCUIT 5 | CIRCUIT 4 | CIRCUIT 3 | CIRCUIT 2 | CIRCUIT 1



1. ALL RESISTORS ARE 1/4W, 10%, UNLESS OTHERWISE SPECIFIED

LIST OF MATERIALS			

SCHEMATIC DIAGRAM LAMP DRIVER AD.

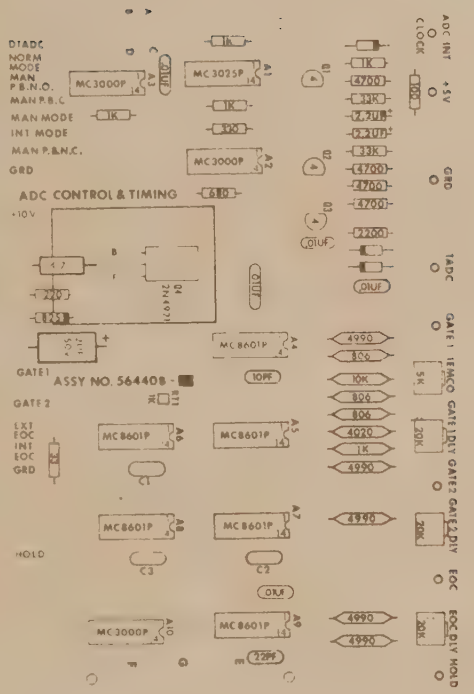
PRESTON SCIENTIFIC

518 45

D

51846-T

REV	ZONE	LTR	DATE	APPR
A		PLR		
B		4365		

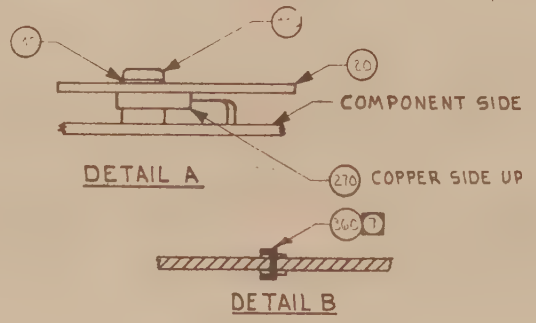


PRINTED CIRCUIT ASSY ADC CONTROL & TIMING			56440-T	56425
				NEXT ASSY

FOR NOTES SEE SH 2.

MASTER* 56

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHEET ONE		



DETAIL A

DETAIL B

NOTES: UNLESS OTHERWISE SPECIFIED

1. HOLES IN COMPONENT SIDE CIRCUITRY ARE FEED THRU HOLES.
2. FOR [illegible] THRU HOLES SEE DETAIL B
3. SOLDER WIRE (ITEM 360) ON BOTH SIDES.
4. FOR HEAT SINK ASSY SEE DETAIL A.
5. FOR [illegible] SEE SH 3 OF 4
6. ALL DIODES ARE IN4148.
7. [illegible] SELECTED IN TEST PER CHART SEE SH 3 OF 4.
8. ALL RESISTORS ARE 1/4W 10%.
9. FOR SCHEMATIC DIAGRAM SEE DWG NO. 56441.

BY	DATE	TITLE	PRESTON SCIENTIFIC INCORPORATED
DRAWN		PRINTED CIRCUIT ASSY [illegible] CONTROL & TIMING	
CHK		MATERIAL	
ENGR		FINISH	A 56440-T
APPD		SCALE	SIZE CODE SH 2 OF 4
APPD		NEXT ASSY	

MASTER NO. 93

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

DELAY SPAN CODE FOR C1-C3		
C1 THRU C3		DELAY SPAN
VALUE	PART NO.	IN N.S.
10 PF	52-01	70 - 220
22	55-01	100 - 350
47	58-01	160 - 600
100	61-01	260 - 1,000
220	66-00	500 - 2000
470	72-01	1000 - 4200
1000 PF	76-02	2000 - 8000
.0022UF	98-00	4500 - 20,000
.0047UF	81-00	9000 - 37500

TABULATION			
DASH NO	WIRE FROM TO	A3	WIRE FROM-TO
56440-0	A-B	OMIT	G - F
56440-1	A-C B-D	INSTALL	E - F

BY	DATE
DRAWN	10/22/71
CHK	
ENGR	11/4/71
APPD	
APPD	

TITLE: PRINTED CIRCUIT ASSY ADC CONTROL & TIMING

MATERIAL

FINISH

SCALE

PRESTON

SCIENTIFIC INCORPORATED
905 East Cerritos Ave. Anaheim, Calif. 92805
Tel. (714) 776-6400

56425 NEXT ASSY

A SIZE

56440-T

CODE | SH 3 OF 9

TITLE: P.C. ASSY ADC CONTROL & TIMING
DWG NO. 56440-00 REV A
SHEET 4 OF 9

PRESTON SCIENTIFIC INC.
PRINTED 11/05/71

PARTS LIST

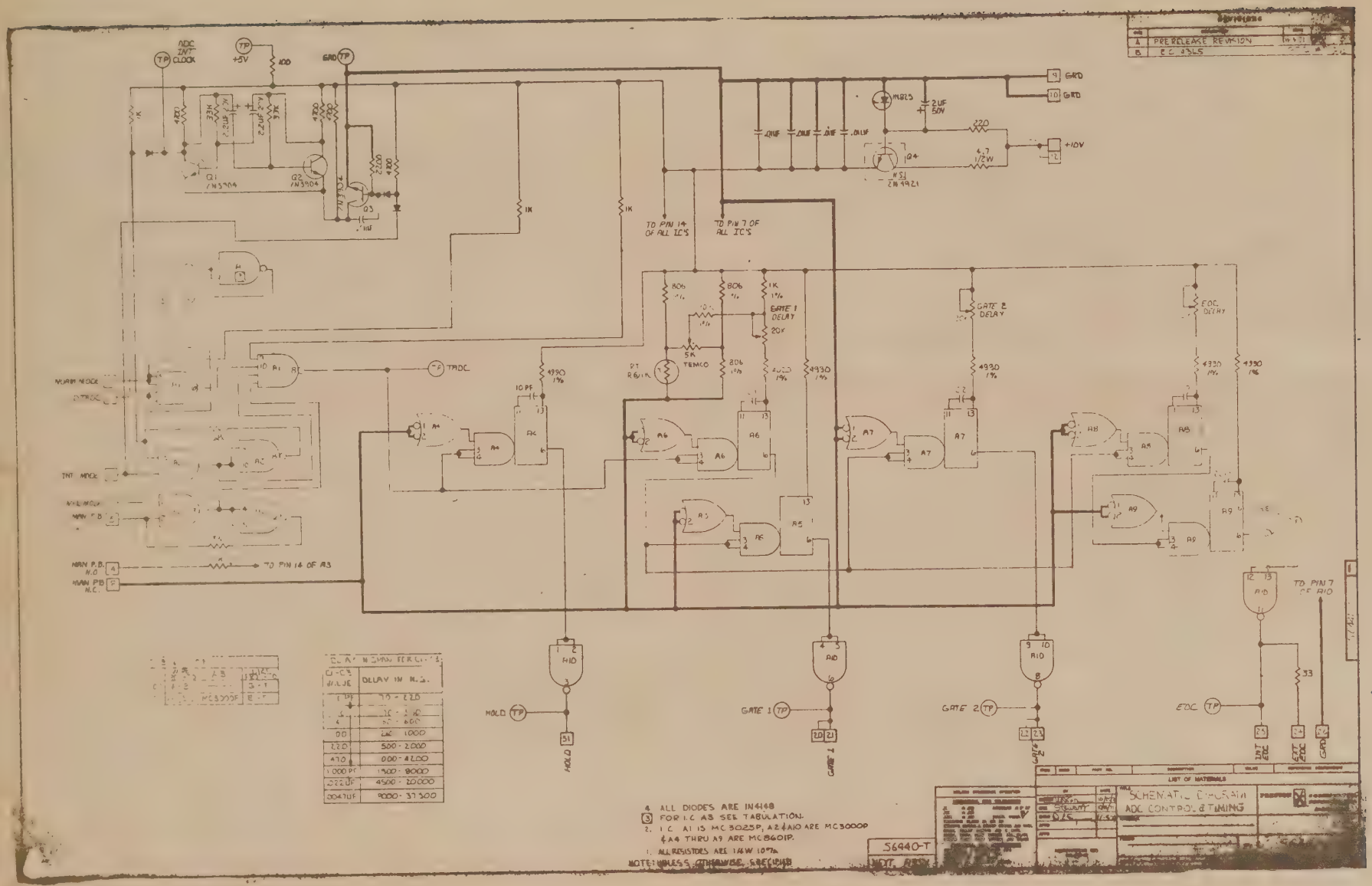
ITEM	QTY	PART NO.	DESCRIPTION
10	1	56443-00	DRILL & RIVET ASSY
20	.1	46079-00	HEAT SINK
30	1	522-00	RESISTOR 1/4W 10% 33
40	1	525-00	RESISTOR 1/4W 10% 100
50	1	527-00	RESISTOR 1/4W 10% 220
60	1	528-00	RESISTOR 1/4W 10% 330
70	1	530-00	RESISTOR 1/4W 10% 680
80	4	531-00	RESISTOR 1/4W 10% 1K
90	1	533-00	RESISTOR 1/4W 10% 2200
100	4	536-00	RESISTOR 1/4W 10% 4700
110	2	543-00	RESISTOR 1/4W 10% 33K
120	3	408-00	RESISTOR 1/4W 1% 806
130	1	409-00	RESISTOR 1/4W 1% 1K
140	1	440-00	RESISTOR 1/4W 1% 4020
150	5	445-00	RESISTOR 1/4W 1% 4990
160	1	456-03	RESISTOR 1/4W 1% 10K
170	1	559-00	RESISTOR 1/2W 10% 4.7
180	1	351-80	POTENTIOMETER 5K
190	3	360-03	POTENTIOMETER 20K
200	1	52-01	CAPACITOR 10PF
210	1	55-01	CAPACITOR 22PF
220	5	93-01	CAPACITOR .01UF
225	1	116-00	CAPACITOR 2UF 50V
230	2	131-00	CAPACITOR 2.2UF 20V
240	1	238-00	DIODE 1N825
250	3	239-00	DIODE 1N4148
260	3	846-00	TRANSISTOR 2N3904
270	1	846-03	TRANSISTOR 2N4921
280	1	374-04	THERMISTOR 1K
290	2	848-14	INTEGRATED CIRCUIT MC3000P
300	1	848-22	INTEGRATED CIRCUIT MC3025P
310	6	848-98	INTEGRATED CIRCUIT MC8601P
320	A/R	994-11	WIRE 22AWG
330	1	665-00	SCREW 4-40 X 5/16 PHMS
340	1	859-00	WASHER SHOULDER
350	A/R	904-00	SILICONE GREASE
360	A/R	989-00	WIRE 22 AWG

TITLE: P.C. ASSY ADC CONTROL & TIMING
DWG NO. 56440_01 REV A
SHEET 4 OF 9

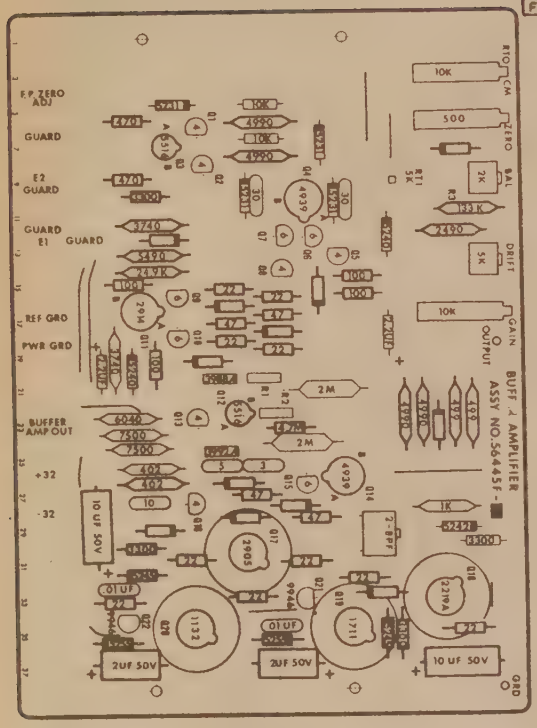
PRESTON SCIENTIFIC INC.
PRINTED 11/05/71

PARTS LIST

ITEM	QTY	PART NO.	DESCRIPTION
10	1	56443-00	DRILL & RIVET ASSY
20	1	460/9-00	HEAT SINK
30	1	522-00	RESISTOR 1/4W 10% 33
40	1	525-00	RESISTOR 1/4W 10% 100
50	1	527-00	RESISTOR 1/4W 10% 220
60	1	528-00	RESISTOR 1/4W 10% 330
70	1	530-00	RESISTOR 1/4W 10% 680
80	4	531-00	RESISTOR 1/4W 10% 1K
90	1	533-00	RESISTOR 1/4W 10% 2200
100	4	536-00	RESISTOR 1/4W 10% 4700
110	2	543-00	RESISTOR 1/4W 10%
120	3	408-00	RESISTOR 1/4W 1% 806
130	1	409-00	RESISTOR 1/4W 1K
140	1	440-00	RESISTOR 1/4W 1% 4020
150	5	445-00	RESISTOR 1/4W 1% 4990
160	1	456-03	RESISTOR 1/4W 1% 10K
170	1	559-00	RESISTOR 1/2W 10% 4.7
180	1	351-80	POTENTIOMETER 5K
190	3	360-03	POTENTIOMETER 20K
200	1	52-01	CAPACITOR 10PF
210	1	55-01	CAPACITOR 22PF
220	5	93-01	CAPACITOR .01UF
225	1	116-00	CAPACITOR 2UF 50V
230	2	131-00	CAPACITOR 2.2UF 20V
240	1	238-00	DIODE 1N825
250	3	239-00	DIODE 1N4148
260	3	846-00	TRANSISTOR 2N3904
270	1	846-03	TRANSISTOR 2N4921
280	1	374-04	THERMISTOR 1K
290	3	848-14	INTEGRATED CIRCUIT MC3000P
300	1	848-22	INTEGRATED CIRCUIT MC30. P
310	6	848-98	INTEGRATED CIRCUIT MC860.P
320	A/R	994-11	WIRE 22AWG
330	1	665-00	SCREW 4-40 X 5/16 PHMS
340	1	859-00	WASHER SHOULDER
350	A/R	904-00	SILICONE GREASE
360	A/R	989-00	WIRE 22 AWG


ADC INT CLOCK
+5V
GND
TO PIN 14 OF ALL IC'S
TO PIN 7 OF ALL IC'S
GATE 1 DELAY
GATE 2 DELAY
EOC DELAY
MAN MODE
INT MODE
MAN P.B. N.O
MAN P.B. N.C.
TO PIN 14 OF A3
TRIGGER DELAY IN N.S.
HOLD
GATE 1
GATE 2
EOC
INT SOC
EXT SOC
COMP
TO PIN 7 OF A10
ALL DIODES ARE IN4148
FOR I.C A3 SEE TABULATION.
I.C A1 IS MC3023P, A2 & A10 ARE MC3000P
& A4 THRU A9 ARE MC8601P.
ALL RESISTORS ARE 1/4W 10%
NOTE: UNLESS OTHERWISE SPECIFIED
SCHEMATIC DIAGRAM
ADC CONTROL & TIMING
56440-T
PRE RELEASE REVISION
P.C. LAYOUT

REV	E.O.NO.	DATE	APP
A	PRR		
B	4206		
C	4250		
D	4265		
E	4290		
F	4305		



PRINTED CIRCUIT ASSY
BUFFER AMPLIFIER

FOR NOTES SEE SH 2.

56445-T

52400
NEXT ASSY

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SH 1 OF 4		

TABULATION					
DWG NO.	FUNCTION	R1 VALUE	PART NO.	R2 VALUE	PART NO.
56445-00	5V F.S.	1996	998-20	1996	998-20
56445-01	10V F.S.	3988.4	998-25	3988.4	998-25
56445-02	10.24V F.S.	4084	998-42	4084	998-42

6. FOR LIST OF MATERIALS SEE SHS 3 & 4.
5 SEE TABULATION FOR VALUE OF R1 & R2.
4. INSTALL HEAT SINK (ITEM 530) ON TRANSISTORS Q17-Q20 USING SILICONE GREASE (ITEM 540).
3. FOR SCHEMATIC DIAGRAM SEE DWG NO. 56445-T.
2. ALL DIODES ARE IN4148.
1. ALL CAPACITOR VALUES ARE IN PF.
NOTE: UNLESS OTHERWISE SPECIFIED

BY	DATE
DRAWN	10/27/71
CHK	11/9/71
ENGR	
APPR	11/17/71
APPD	

TITLE: PRINTED CIRCUIT ASSY BUFFER AMPLIFIER

MATERIAL

FINISH

SCALE

PRESTON
SCIENTIFIC INCORPORATED
805 East Cerritos Ave., Anaheim, Calif. 92805
Tel. (714) 776-6400

NEXT ASSY 52400

A

56445-T

SH 2 OF 4

TITLE: P.C. ASSY BUFFER AMPLIFIER
DWG NO. 56445-00 REV E
SHEET 3 OF 4

PRESTON SCIENTIFIC INC.
PRINTED 3/09/72

PARTS LIST

ITEM	QTY	PART NO.	DESCRIPTION
010	1	56448-00	DRILL & RIVET ASSY
020	10	521-00	RESISTOR 1/4W 10% 22
030	4	523-00	RESISTOR 1/4W 10% 47
040	4	525-00	RESISTOR 1/4W 10% 100
050	2	529-00	RESISTOR 1/4W 10% 470
070	4	535-00	RESISTOR 1/4W 10% 3300
080	2	538-00	RESISTOR 1/4W 10% 10K
090	1	555-00	RESISTOR 1/4W 10% 4.7M
100	2	401-04	RESISTOR 1/4W 1% 402
110	2	402-02	RESISTOR 1/4W 1% 499
120	1	409-00	RESISTOR 1/4W 1% 1K
130	1	427-00	RESISTOR 1/4W 1% 2490
140	2	439-01	RESISTOR 1/4W 1% 3740
150	4	445-00	RESISTOR 1/4W 1% 4990
160	1	446-00	RESISTOR 1/4W 1% 5490
170	1	448-00	RESISTOR 1/4W 1% 6040
180	2	451-06	RESISTOR 1/4W 1% 7500
190	1	467-03	RESISTOR 1/4W 1% 24.9K
200	1	478-05	RESISTOR 1/4W 1% 154K
220	2	488-11	RESISTOR 1/2W 1% 2M
230	2	998-20	RESISTOR .03% 1996
240	1	998-25	RESISTOR .03% 3988.4
250	1	998-30	RESISTOR .03% 3992.4
255	1	374-02	THERMISTOR R@5K
260	1	344-07	POTENTIOMETER 500
270	1	346-80	POTENTIOMETER 2K
280	1	351-80	POTENTIOMETER 5K
290	2	359-03	POTENTIOMETER 10K
300	1	48-00	CAPACITOR 3PF
310	1	50-01	CAPACITOR 5PF
320	1	52-01	CAPACITOR 10PF
325	2	56-01	CAPACITOR 30PF
330	1	79-01	CAPACITOR 2-8PF
340	2	93-01	CAPACITOR .01UF
350	2	116-00	CAPACITOR 2UF 50V
360	2	131-00	CAPACITOR 2.2UF 20V
370	2	142-01	CAPACITOR 10UF 50V
380	12	239-00	DIODE 1N4148
390	4	248-06	DIODE 1N5231B
400	2	248-10	DIODE 1N5240B
410	1	237-00	DIODE 1N5242B
420	2	248-12	DIODE 1N5245B
430	2	247-20	DIODE 1N5255B
440	1	824-00	TRANSISTOR 2N1132
450	1	828-00	TRANSISTOR 2N1711
460	1	830-02	TRANSISTOR 2N2219A
470	1	838-02	TRANSISTOR 2N2905
480	1	838-04	TRANSISTOR 2N2914
490	6	846-00	TRANSISTOR 2N3904
500	5	846-01	TRANSISTOR 2N3906

TITLE: P.C. ASSY BUFFER AMPLIFIER
DWG NO. 56445-00 REV E
SHEET 4 OF 4

PRESTON SCIENTIFIC INC.
PRINTED 3/09/72

PARTS LIST

ITEM	QTY	PART NO.	DESCRIPTION
510	2	846-08	TRANSISTOR 2N4939
520	2	847-12	TRANSISTOR 2N5516
525	2	9946-00	TRANSISTOR 9946
530	4	284-01	HEAT SINK
540	A/R	904-00	SILICONE GREASE
550	A/R	994-11	WIRE 22AWG

TITLE: P.C. ASSY BUFFER AMPLIFIER — PRESTON SCIENTIFIC INC.
DWG NO. 56445-01 REV F — PRINTED 3/09/72
SHEET 3 OF 4

PARTS LIST

ITEM	QTY	PART NO.	DESCRIPTION
010	1	56448-00	DRILL & RIVET ASSY
020	10	521-00	RESISTOR 1/4W 10% 22
030	4	523-00	RESISTOR 1/4W 10% 47
040	4	525-00	RESISTOR 1/4W 10% 100
050	2	529-00	RESISTOR 1/4W 10% 470
070	4	535-00	RESISTOR 1/4W 10% 3300
080	2	538-00	RESISTOR 1/4W 10% 10K
090	1	555-00	RESISTOR 1/4W 10% 4.7M
100	2	401-04	RESISTOR 1/4W 1% 402
110	2	402-02	RESISTOR 1/4W 1% 499
120	1	409-00	RESISTOR 1/4W 1% 1K
130	1	427-00	RESISTOR 1/4W 1% 2490
140	2	439-01	RESISTOR 1/4W 1% 3740
150	4	445-00	RESISTOR 1/4W 1% 4990
160	1	446-00	RESISTOR 1/4W 1% 5490
170	1	448-00	RESISTOR 1/4W 1% 6040
180	2	451-06	RESISTOR 1/4W 1% 7500
190	1	467-03	RESISTOR 1/4W 1% 24.9K
200	1	478-05	RESISTOR 1/4W 1% 154K
220	2	488-11	RESISTOR 1/2W 1% 2M
240	3	998-25	RESISTOR .03% 3988.4
250	1	998-30	RESISTOR .03% 3992.4
255	1	374-02	THERMISTOR R@5K
260	1	344-07	POTENTIOMETER 500
270	1	346-80	POTENTIOMETER 2K
280	1	351-80	POTENTIOMETER 5K
290	2	359-03	POTENTIOMETER 10K
300	1	48-00	CAPACITOR 3PF
310	1	50-01	CAPACITOR 5PF
320	1	52-01	CAPACITOR 10PF
325	2	56-01	CAPACITOR 30PF
330	1	79-01	CAPACITOR 2-8PF
340	2	93-01	CAPACITOR .01UF
350	2	116-00	CAPACITOR 2UF 50V
360	2	131-00	CAPACITOR 2.2UF 20V
370	2	142-01	CAPACITOR 10UF 50V
380	12	239-00	DIODE 1N4148
390	4	248-06	DIODE 1N5231B
400	2	248-10	DIODE 1N5240B
410	1	237-00	DIODE 1N5242B
420	2	248-12	DIODE 1N5245B
430	2	247-20	DIODE 1N5255B
440	1	824-00	TRANSISTOR 2N1132
450	1	828-00	TRANSISTOR 2N1711
460	1	830-02	TRANSISTOR 2N2219A
470	1	838-02	TRANSISTOR 2N2905
480	1	838-04	TRANSISTOR 2N2914
490	4	846-00	TRANSISTOR 2N3904
500	5	846-01	TRANSISTOR 2N3906
510	2	846-08	TRANSISTOR 2N4939

TITLE: P.C. ASSY BUFFER AMPLIFIER — PRESTON SCIENTIFIC INC.
DWG NO. 56445-01 REV F — PRINTED 3/09/72
SHEET 4 OF 4

PARTS LIST

ITEM	QTY	PART NO.	DESCRIPTION
520	2	847-12	TRANSISTOR 2N5516
525	2	9946-00	TRANSISTOR 9946
530	4	284-01	HEAT SINK
540	A/R	904-00	SILICONE GREASE
550	A/R	994-11	WIRE 22AWG

TITLE: P.C. ASSY BUFFER AMPLIFIER — PRESTON SCIENTIFIC INC.
DWG NO. 56445-02 REV F — PRINTED 3/09/72
SHEET 3 OF 4

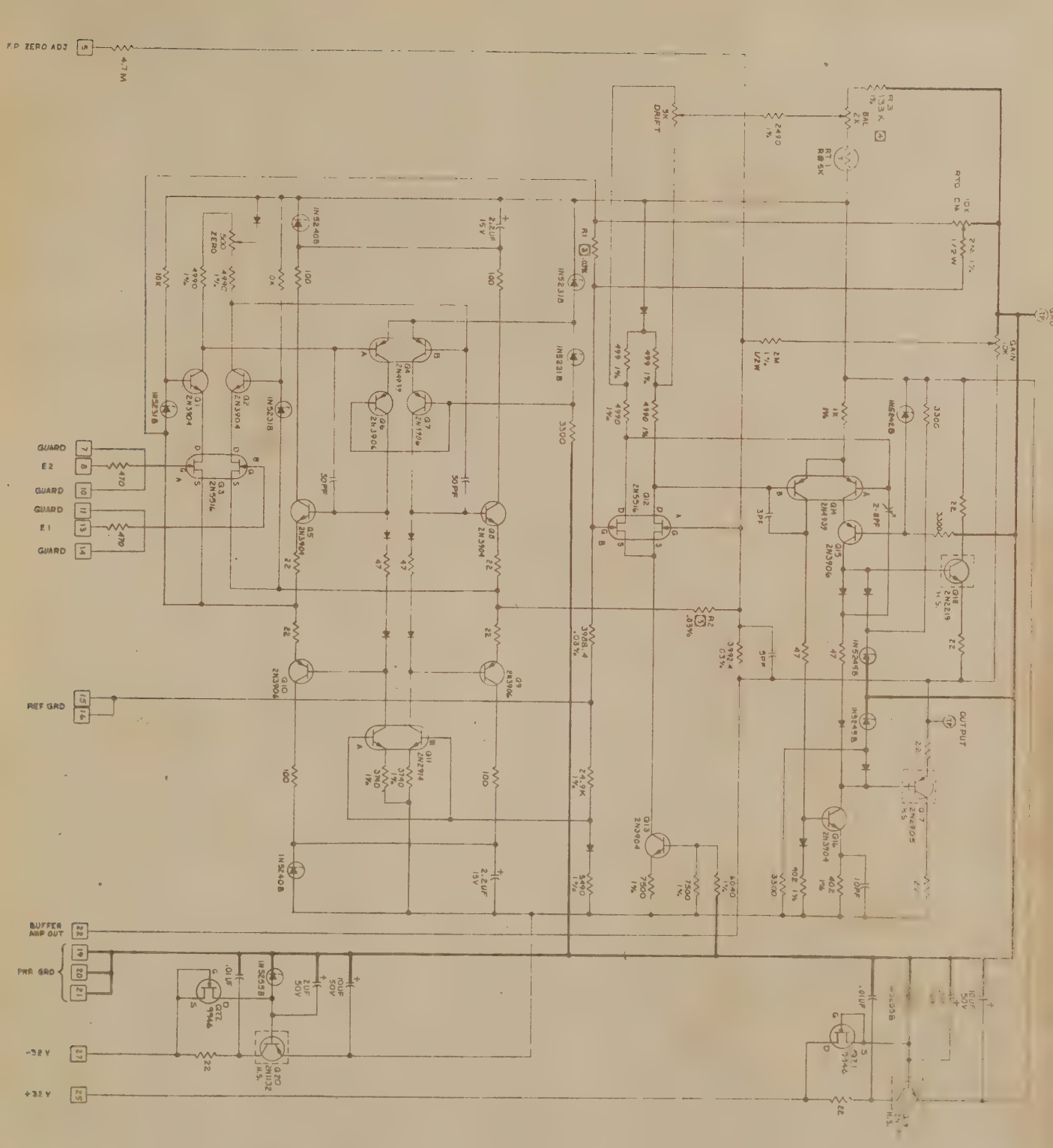
PARTS LIST

ITEM	QTY	PART NO.	DESCRIPTION
010	1	56448-00	DRILL & RIVET ASSY
020	10	521-00	RESISTOR 1/4W 10% 22
030	4	523-00	RESISTOR 1/4W 10% 47
040	4	525-00	RESISTOR 1/4W 10% 100
050	2	529-00	RESISTOR 1/4W 10% 470
070	4	535-00	RESISTOR 1/4W 10% 3300
080	2	538-00	RESISTOR 1/4W 10% 10K
090	1	555-00	RESISTOR 1/4W 10% 4.7M
100	2	401-04	RESISTOR 1/4W 1% 402
110	2	402-02	RESISTOR 1/4W 1% 499
120	1	409-00	RESISTOR 1/4W 1% 1K
130	1	427-00	RESISTOR 1/4W 1% 2490
140	2	439-01	RESISTOR 1/4W 1% 3740
150	4	445-00	RESISTOR 1/4W 1% 4990
160	1	446-00	RESISTOR 1/4W 1% 5490
170	1	448-00	RESISTOR 1/4W 1% 6040
180	2	451-06	RESISTOR 1/4W 1% 7500
190	1	467-03	RESISTOR 1/4W 1% 24.9K
200	1	478-05	RESISTOR 1/4W 1% 154K
220	2	488-11	RESISTOR 1/2W 1% 2M
230	2	998-42	RESISTOR .03% 4084
240	1	998-25	RESISTOR .03% 3988.4
250	1	998-30	RESISTOR .03% 3992.4
255	1	374-02	THERMISTOR R@5K
260	1	344-07	POTENTIOMETER 500
270	1	346-80	POTENTIOMETER 2K
280	1	351-80	POTENTIOMETER 5K
290	2	359-03	POTENTIOMETER 10K
300	1	48-00	CAPACITOR 3PF
310	1	50-01	CAPACITOR 5PF
320	1	52-01	CAPACITOR 10PF
325	2	56-01	CAPACITOR 30PF
330	1	79-01	CAPACITOR 2-8PF
340	2	93-01	CAPACITOR .01UF
350	2	116-00	CAPACITOR 2UF 50V
360	2	131-00	CAPACITOR 2.2UF 20V
370	2	142-01	CAPACITOR 10UF 50V
380	12	239-00	DIODE 1N4148
390	4	248-06	DIODE 1N5231B
400	2	248-10	DIODE 1N5240B
410	1	237-00	DIODE 1N5242B
420	2	248-12	DIODE 1N5245B
430	2	247-20	DIODE 1N5255B
440	1	824-00	TRANSISTOR 2N1132
450	1	828-00	TRANSISTOR 2N1711
460	1	830-02	TRANSISTOR 2N2219A
470	1	838-02	TRANSISTOR 2N2905
480	1	838-04	TRANSISTOR 2N2914
490	4	846-00	TRANSISTOR 2N3904
500	5	846-01	TRANSISTOR 2N3906

TITLE: P.C. ASSY BUFFER AMPLIFIER — PRESTON SCIENTIFIC INC.
DWG NO. 56445-02 REV F — PRINTED 3/09/72
SHEET 4 OF 4

PARTS LIST

ITEM	QTY	PART NO.	DESCRIPTION
510	2	846-08	TRANSISTOR 2N4939
520	2	847-12	TRANSISTOR 2N5516
525	2	9946-00	TRANSISTOR 9946
530	4	284-01	HEAT SINK
540	A/R	904-00	SILICONE GREASE
550	A/R	994-11	WIRE 22AWG



R3 TO BE SELECTED INTEST, NOMINAL VALUE SHOWN
SEE TABULATION FOR VALUES
ALL DIODES ARE IN6146.
ALL RESISTORS ARE V4W 10%.
NOTE: UNLESS OTHERWISE SPECIFIED

DWG. NO.	FUNCTION	R1 VALUE	R2 VALUE
56446-02	10.24 V F.S.	4084	4084
56446-01	10 V F.S.	3988.4	3988.4
56446-00	5 V F.S.	1996	1996

TABULATION

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	EC 4206	12-2-72	[illegible]
B	EC 4250	12-12-72	[illegible]
C	EC 4255	2-10-73	[illegible]
D	EC 4289	5-6-73	[illegible]
E	EC 4	3-9	[illegible]

LIST OF MATERIALS

SCHEMATIC DIAGRAM
BUFFER AMPLIFIER

56445-T

R

NEXT ASSY

SECTION 6

PRESTON
SCIENTIFIC INCORPORATED
805 East Cerritos Ave., Anaheim, Calif. 92805
Tel. (714) 776-6400

MODEL GMAD -3

TEST REPORT

Test Technician S. Fox

Date 4-2-73

Serial Number RAA-267

Register Number 13282

1.0 Assembly number 59550

2.0 Resolution 14 Bits and sign

3.0 Output code 2's comp

4.0 Output level for "1" +3v nom

5.0 Fullscale input ± 10 v

6.0 Number of counts ±16,384

7.0 Setup:

(a) +10 volt reference +10.002 v

(b) Trigger slope positive

(c) Trigger level +3v nom

(d) Delay# Gate 1
9.0 ~~nano~~/microseconds

(e) Delay# Gate 2
9.2 ~~nano~~/micro seconds

(f) Delay# E.O.C.
9.7 ~~nano~~/micro seconds

8.0 Conversion time 10 μsec

9.0 Throughput rate 100KHz

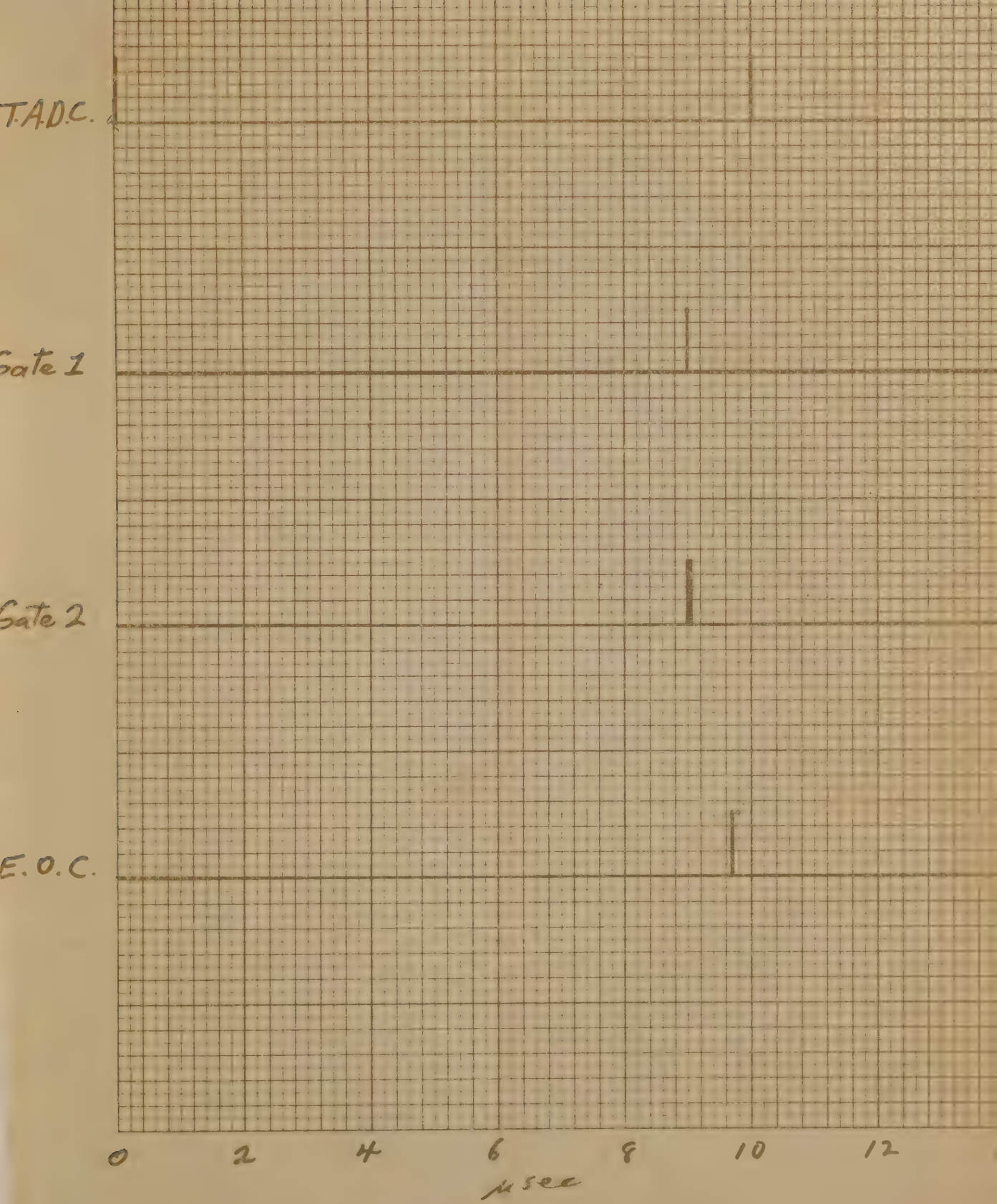
10.0 Accuracy 0.01% ± ½ LSB

11.0 Crossover check O.K.

Model GMAD - 3 ADC Test Report (continued)

12.0 Binary Display (2's Complement)	Theoretical Analog Input ±1.3 mv	Actual Analog Inputs	Error-Theoretical Minus Actual
0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	+9.9994	+9.9993	-.1
0 1 1 1 1 0 0 0 0 0 0 0 0 0 0	+9.3750	+9.3749	-.1
0 1 1 1 0 0 0 0 0 0 0 0 0 0 0	+8.7500	+8.7504	+.4
0 1 1 0 0 0 0 0 0 0 0 0 0 0 0	+7.5000	+7.5003	+.3
0 1 0 0 0 0 0 0 0 0 0 0 0 0 0	+5.0000	+5.0005	+.5
0 0 0 1 0 0 0 0 0 0 0 0 0 0 0	+1.2500	+1.2502	+.2
0 0 0 0 1 0 0 0 0 0 0 0 0 0 0	+0.6250	+0.6253	+.3
0 0 0 0 0 0 0 0 0 0 0 0 1 0	+0.0012	+0.0016	+.4
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0.0000	0.0000	0
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-0.0006	-0.0011	-.5
1 1 1 0 0 0 0 0 0 0 0 0 0 0 0	-0.6250	-0.6256	-.6
1 1 0 1 1 1 1 1 1 1 1 1 1 1 1	-1.2500	-1.2499	+.1
1 1 0 0 0 0 0 0 0 0 0 0 0 0 0	-2.5000	-2.5000	0
1 0 1 1 1 1 1 1 1 1 1 1 1 1 1	-5.0000	-5.0001	-.1
1 0 1 0 0 0 0 0 0 0 0 0 0 0 0	-7.5000	-7.4999	+.1
1 0 0 1 1 1 1 1 1 1 1 1 1 1 1	-8.7500	-8.7498	+.2
1 0 0 1 0 0 0 0 0 0 0 0 0 0 0	-9.3750	-9.3746	+.4
1 0 0 0 0 0 0 0 0 0 0 0 0 0 1	-9.9994	-9.9994	0

13.0 Reading error and crosstalk ± 2 counts maximum



RAA-267

SECTION 7

7.1 GENERAL TROUBLESHOOTING INFORMATION

This section discusses the recommended procedures for troubleshooting the GM Analog-to-Digital Converter (ADC). Prior to troubleshooting, make certain that all instrumentation associated with the ADC is checked to determine that the apparent problem is within the ADC. Check that the proper digital commands are applied to the correct inputs; check the data output lines for proper terminations.

Note: Calibration adjustment potentiometers or capacitors are preset at the factory, therefore no adjustment should be attempted until the ADC has been checked for proper operation.

To effectively check the ADC, it is recommended that the unit be removed from the system whenever possible. Troubleshooting the ADC will be much easier when checked on a test-bench.

Set up the ADC as shown in Figure 7.1. In this setup, it is possible to operate the ADC under the same conditions and conversion rates as in a system. The types of malfunctions that cannot be determined when bench-testing the ADC are those associated with multiplexing (when the multiplexer is in a separate module), system adaptation, etc.

To prevent damage to the semiconductors used in this unit, the main power to the unit should be turned off before plugging or unplugging any circuit card.

7.2 GENERAL TROUBLESHOOTING EQUIPMENT

Equipment recommended for troubleshooting consists of the following.

(a) A stable DC analog voltage source, variable from 0 to ±full scale input voltage. The voltage resolution should be better than 25% of the least significant bit. The impedance should be less than 1000 ohms.

(b) Oscilloscope, Tektronix 545A, with D and CA Preamplifiers, or equivalent

(c) Five-digit digital voltmeter, differential voltmeter, or equivalent. The accuracy should be at least twice that of the ADC being tested.

(d) Standard VOM, such as Simpson 260

(e) Any standard pulse generator to provide digitize command pulses of at least 100 nanoseconds wide (1×10^{-7}).

(f) Printed circuit card extender, bit board extender (Part No. 52315), and sample-and-hold/buffer extender (Part No. 52318). (All three are supplied with the unit)

7.3 TROUBLESHOOTING PROCEDURES FOR POWER SUPPLY

	Indication	Check
7.3.1	Loss of power	Line fuse, power ON-OFF switch, and line cord connections
7.3.2	Loss of data output bit display on front panel	Assuming the ADC is operating correctly, check the +175 volt point located in Figure 7.4 (power supply test point). A full save rectified and filtered +175 volts DC should appear at this test point. If the DC voltage is not present at this point, check between points 6 and 7 of the circuit side of the board for an AC voltage. (Refer to the schematic of the interconnect power supply)

7.3.3	Low or non-existent ±10v or ±33v DC	First check to see that all plug-in boards are seated properly and that there are no shorts caused by a piece of metal foreign matter. If the above check has been made and the problem still exists, make the same checks as in Section 7.3.2 for the ±10v and ±33v supplies.

7.4 ADC PROBLEMS AND POSSIBLE SOLUTION

Refer to the block diagram, Figure 7.2, for a flow-chart relating to ADC problems and their solutions, by category.

7.4.1 Faulty Positive Reference Power Supply

The reference power supply provides a precisly regulated, highly stabilized reference voltage for use in the ADC bit boards. It consists of two differential amplifiers; each is an operational amplifier with its own feedback loop. The primary standard reference is a zener diode. The reference control (REF) adjusts the output voltage of the minus supply, and the +10v control adjusts the output voltage of the plus supply.

A faulty positive reference supply will have the following indications:

(a) An error in the digital information (gain error)

(b) A zero offset which cannot be removed with front panel adjustment

Check the +10 volt reference supply at the test points on the circuit board. It should be adjustable with the gain potentiometer located on that board and labeled +10V.

7.4.2 Faulty Negative Reference Supply

A faulty negative reference supply will give a gain error, except that the zero offset will not be affected. Make the same checks as in Section 7.4.1, using the negative test point (-10V) and adjustment potentiometer (REF).

7.4.3 Incorrect Calibration of Buffer or Sample-and-Hold Amplifiers

Incorrect data and zero offsets may be due to adjustments in the analog area of the ADC such as the buffer or the sample-and-hold amplifiers.

Check the calibration of the buffer or sample-and-hold amplifiers to see if the problem exists in this area. If the buffer or sample-and-hold amplifiers are not at fault and the reference power supplies have been ruled out as the problem area, refer to Section 7.4.4.

7.4.4 Defective Bit Board

An incorrect digital output may be caused by an uncalibrated bit board or by some malfunction of a bit board.

Check the bit board in question by using the calibration procedure described in Section 3 (only that portion describing the method for introducing a signal into the bit board in question). Also place the bit board in question on the plain extender, Part No. 48289, so that test points of individual parts on the board may be available.

Introduce a 1000 Hz triangular wave of a peak-to-peak value of 20v (see Figure 7.3) into the bit board and view the output of the board at A1 and A2.

7.4.4 (continued)

Trigger the ADC for a conversion at a rate of 10 kHz. The result is shown for a good board in Figure 7.3. Also refer to Figures 2.2 and 2.3 for clarification.

If the signals on the Test Points A1 and A2 are correct, check the waveforms on the bases and collectors of Q17 and Q18, and at Pints 6 and 8 of the IC's A1, A2 and A3.

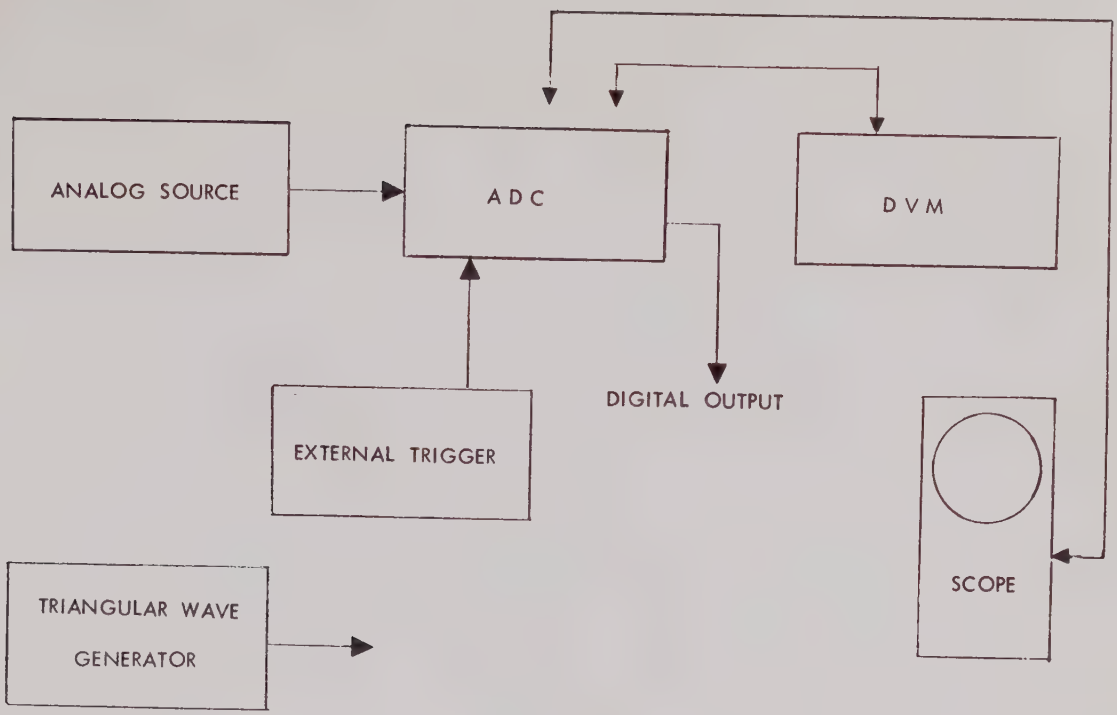


FIGURE 7.1

BENCH TEST SETUP

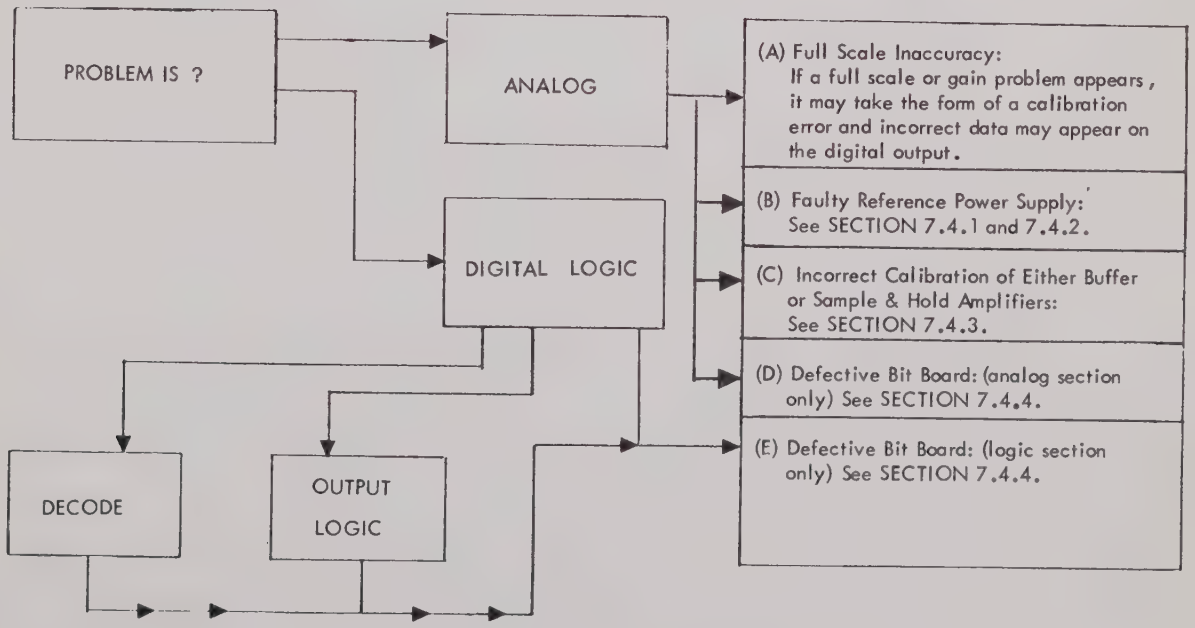

PROBLEM IS ?
ANALOG
DIGITAL LOGIC
DECODE
OUTPUT
LOGIC
(A) Full Scale Inaccuracy:
If a full scale or gain problem appears, it may take the form of a calibration error and incorrect data may appear on the digital output.
(B) Faulty Reference Power Supply:
See SECTION 7.4.1 and 7.4.2.
(C) Incorrect Calibration of Either Buffer or Sample & Hold Amplifiers:
See SECTION 7.4.3.
(D) Defective Bit Board: (analog section only) See SECTION 7.4.4.
(E) Defective Bit Board: (logic section only) See SECTION 7.4.4.

FIGURE 7.2

TROUBLESHOOTING FLOW BLOCK DIAGRAM

GMAD

APPENDIX

ADDENDUM

The following corrections are to be made to the text in this document.

(1) Section 3, Paragraph 3.3.1 (c), (d), (e), (f), (g), (h), (i), (j) and (k) . . . Add to each of these paragraphs, "Refer to Figure 3.5

(2) Section 3, Paragraph 3.3.3 (a), (b), (c), (d), (e), (f) and (g) . . . Add to each of the paragraphs: "Refer to Figure 3.6

(3) Section 3, Paragraphs 3.4.2, 3.4.3 and 3.4.4 . . . Add to each of the paragraphs: "Refer to Figure 3.7

SWINGLINE INC
LONG ISLAND CITY, NY
MADE IN U.S.A.